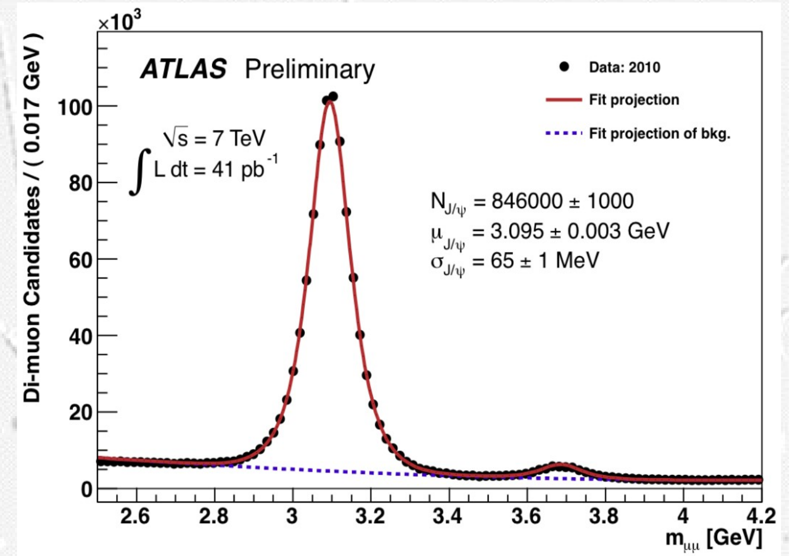
Identification de Suspects Particules

The Usual Suspects

$e^{\pm}$	γ	$\mu^{\pm}$	Hadrons chargés **p,k$^{\pm}$,π$^{\pm}$...**	Hadrons neutres **n,π^{0},λ,...**

Introduction



Identification

- Découvrir la nature , l'identité
- Masse, charge
- Ne serait ce pas une question idiote $\Delta p\, \Delta x > h/2\pi$?

Particules à durée de vie courte (<~10^{-10}s)

- W,Z,J/psi,π^0... (Interaction em, faible, forte)
- Identification passe par la reconstruction du produits de leur désintégration
- Identification au sens statistique (séparation bruit de fond / particule)
  - Efficacité, pureté...

Introduction

Particules « stables »

- Particules réellement stables
- Leur durée de vie excède le temps pour traverser le détecteur

Exemples

- $\mu^{\pm}$: laisse une trace dans chaque détecteur
- $\pi^{\pm}$, $K^{\pm}(K_s,K_l)$, p, n... : calorimètre hadronique
  - Identification va dépendre de leur vitesse
- **Neutrino** : Principalement énergie manquante
  - Ou à travers un muon (Cherenkov : Antares, SK,...)
- **Électron, photon**, π^0 : mesures d'énergie dans les calorimètres
  - Avec ou sans trace chargée dans le trajectographe

Identification

Charge

- Champ magnétique
- Mesure du rayon de courbure
- Précision de l'alignement +
  valeur du champ limite la séparation de charge

Masse

- Mesure simultanée pour : π,K,μ,e,p...
  - Impulsion & énergie
  - Impulsion & vitesse
  - Énergie & vitesse

Identification directe

- μ,e

Identification

Principes de Physiques: Interactions électromagnétiques

- Mesure simultanée de l'impulsion &
  - dEdx
  - Temps de vol
  - Cherenkov

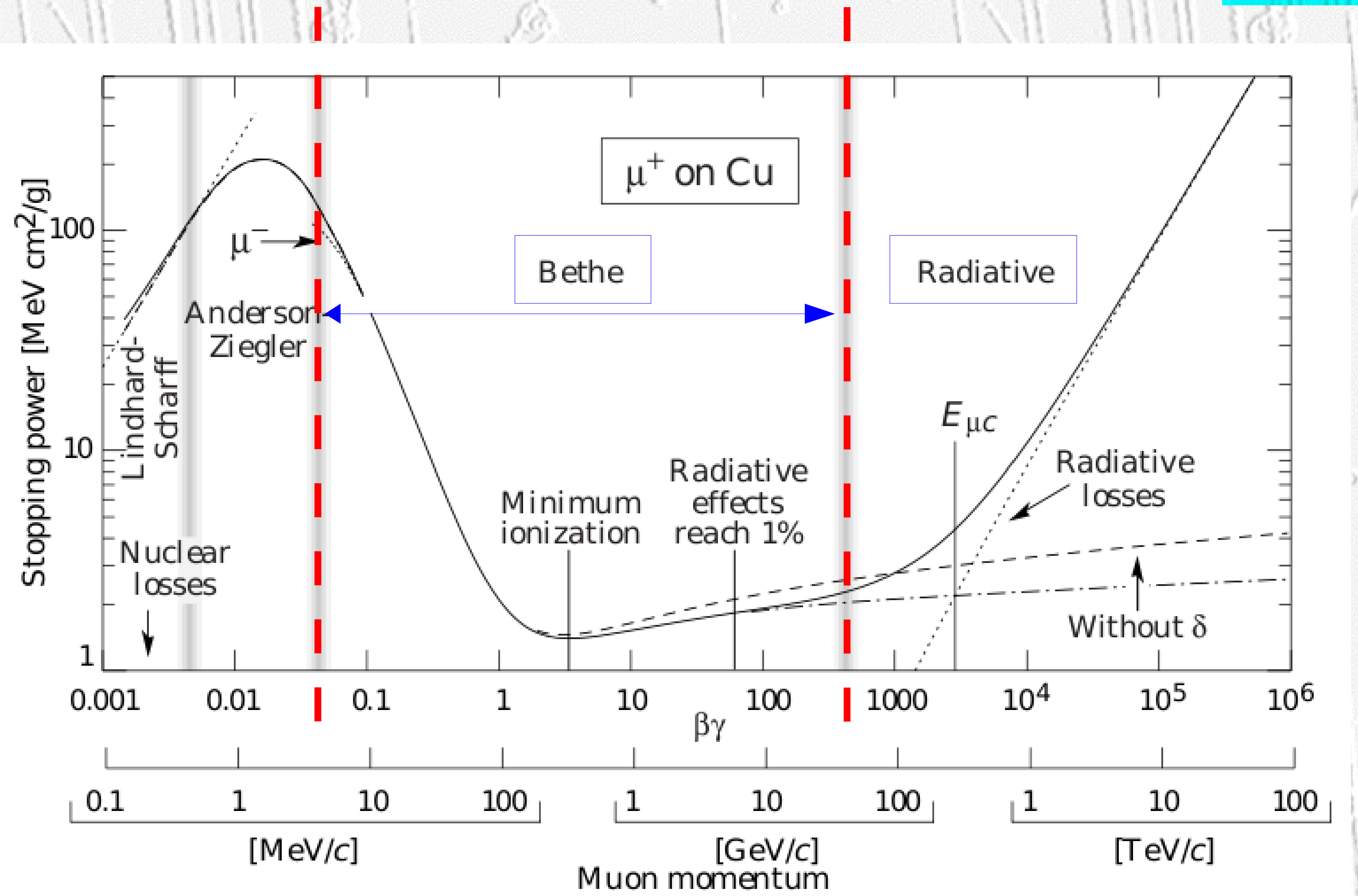
$$\begin{cases} p = \gamma M \beta c \\ \frac{dE}{dx} \propto \frac{1}{\beta^2} \ln\left(\beta^2 \gamma^2\right) \end{cases}$$

- Rayonnement de transition
  - Séparation π/e
  - Identification directe des électrons

Identification

dE/dx

$$-\frac{dE}{dx} = Kz^2\frac{Z}{A}\frac{1}{\beta^2}\left[\frac{1}{2}\ln\frac{2m_ec^2\beta^2\gamma^2T_{max}}{I^2} - \beta^2 - \frac{\delta(\beta\gamma)}{2}\right] \propto \frac{1}{\beta^2}\ln\left(\beta^2\gamma^2\right)$$

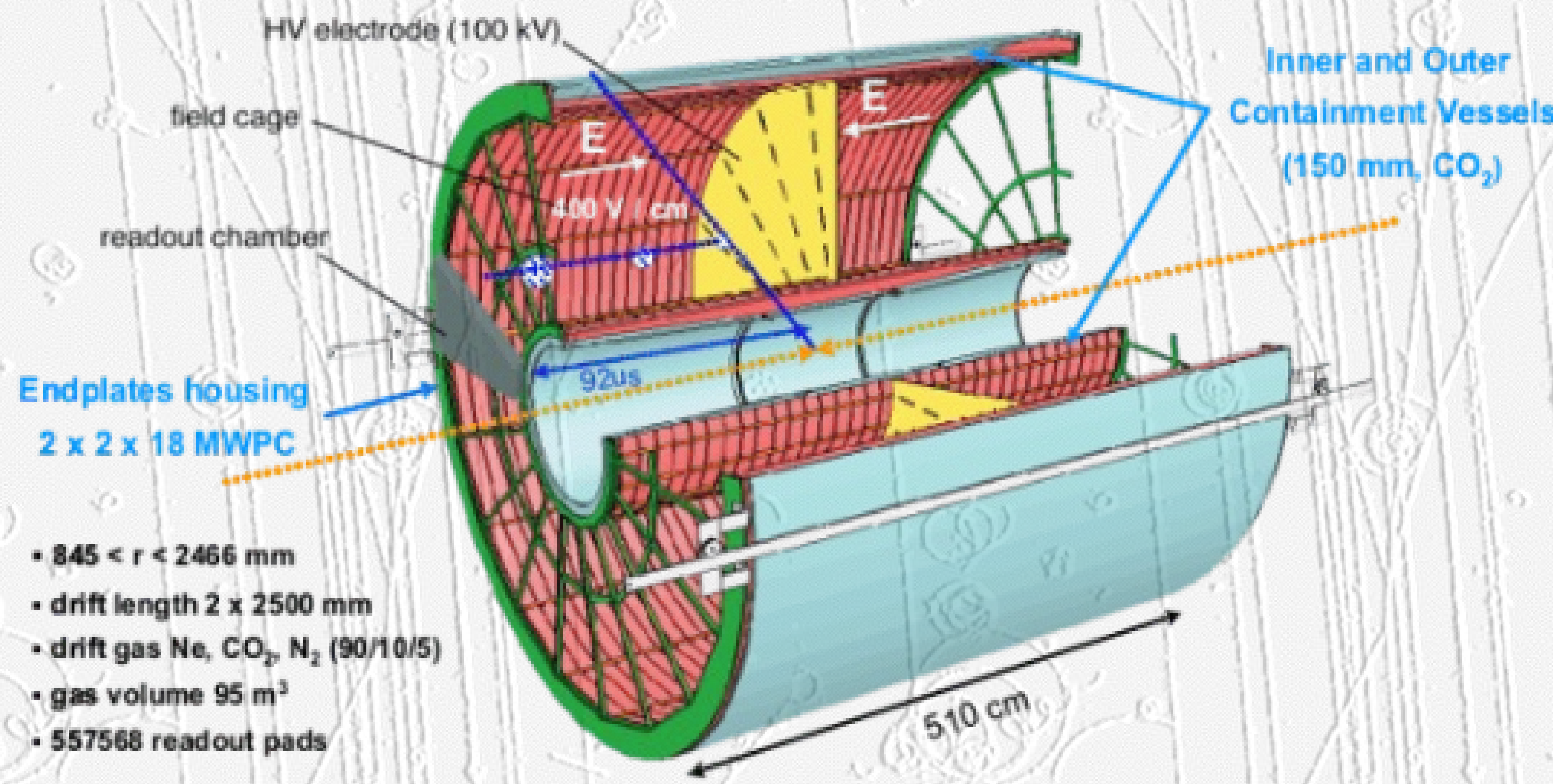


Identification

$$p = \gamma M \beta c$$

dE/dx

$$\frac{dE}{dx} \propto \frac{1}{\beta^2} \ln\left(\beta^2 \gamma^2\right)$$



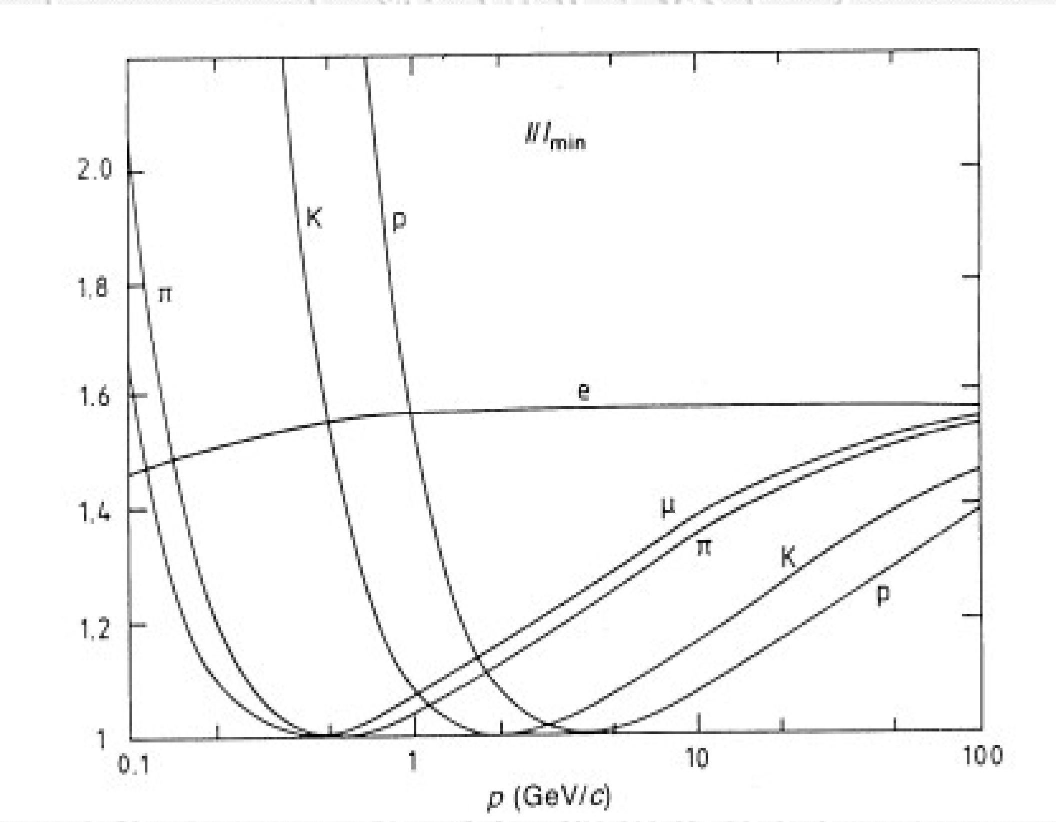
- 845 < r < 2466 mm
- drift length 2 x 2500 mm
- drift gas Ne, CO_2, N_2 (90/10/5)
- gas volume 95 m^3
- 557568 readout pads

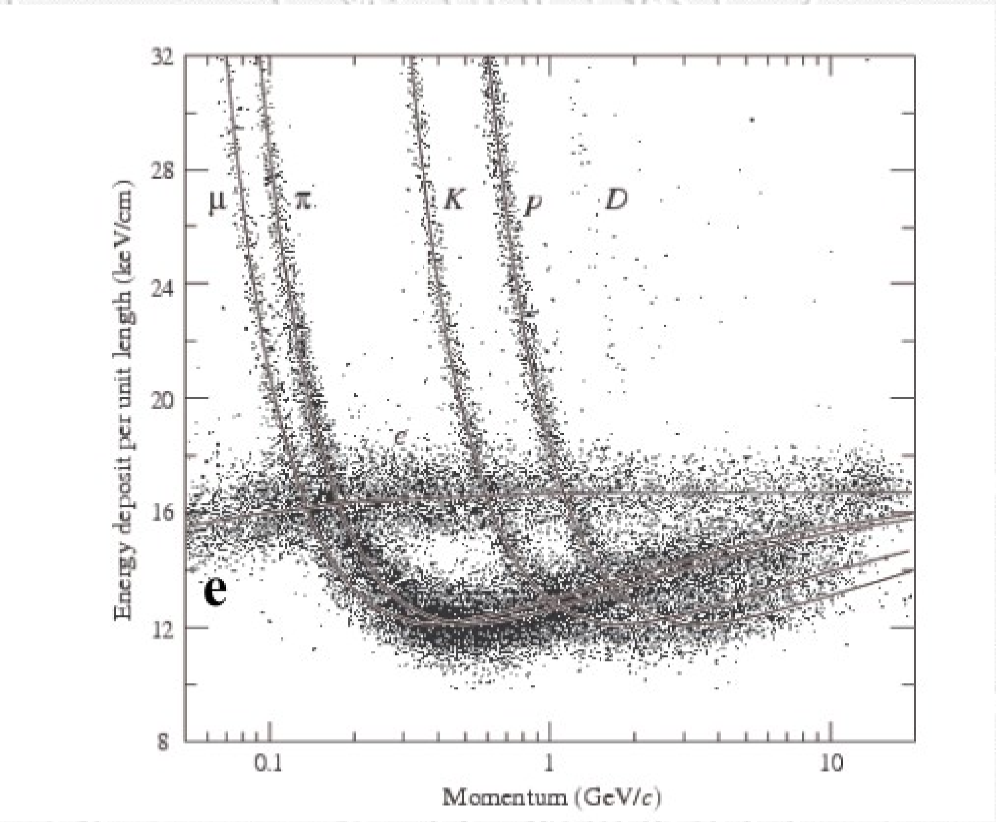
Identification

dE/dx

$$p = \gamma M \beta c$$

$$\frac{dE}{dx} \propto \frac{1}{\beta^2} \ln(\beta^2 \gamma^2)$$

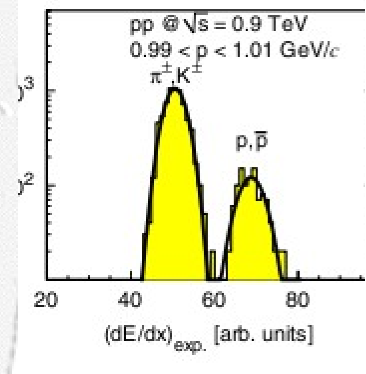




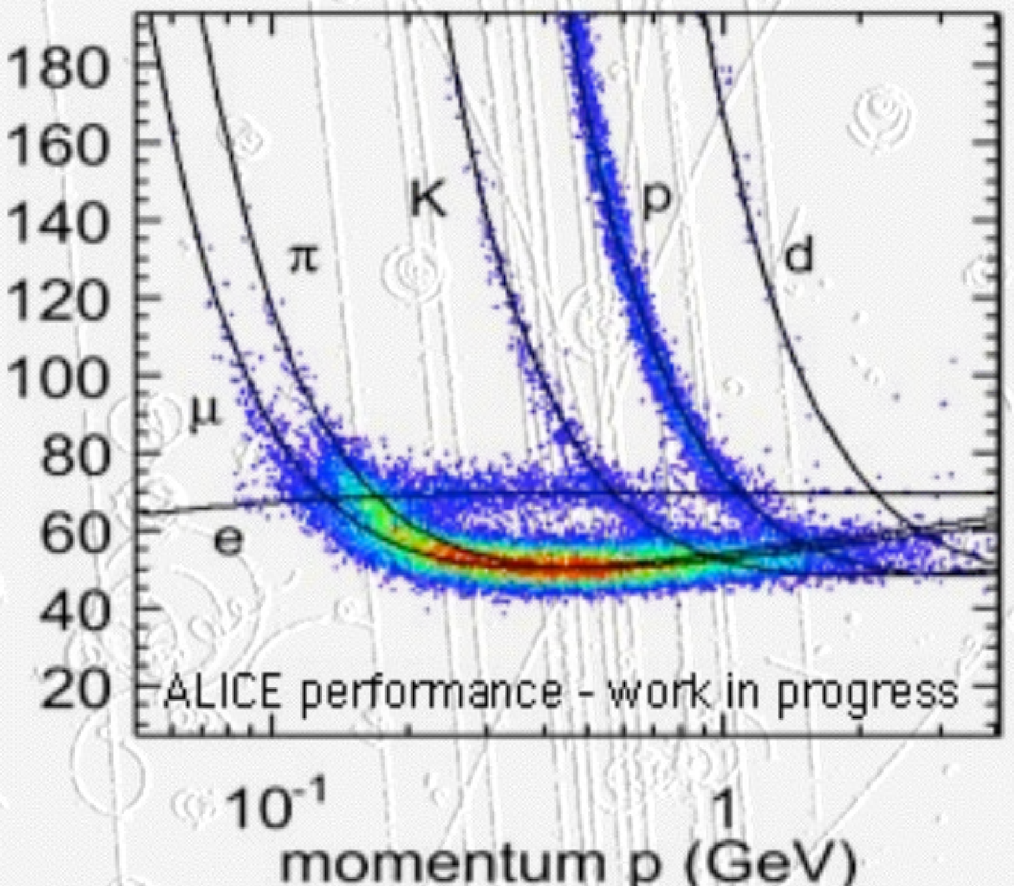
Gamme d'énergie : ~0.1-->~10 GeV

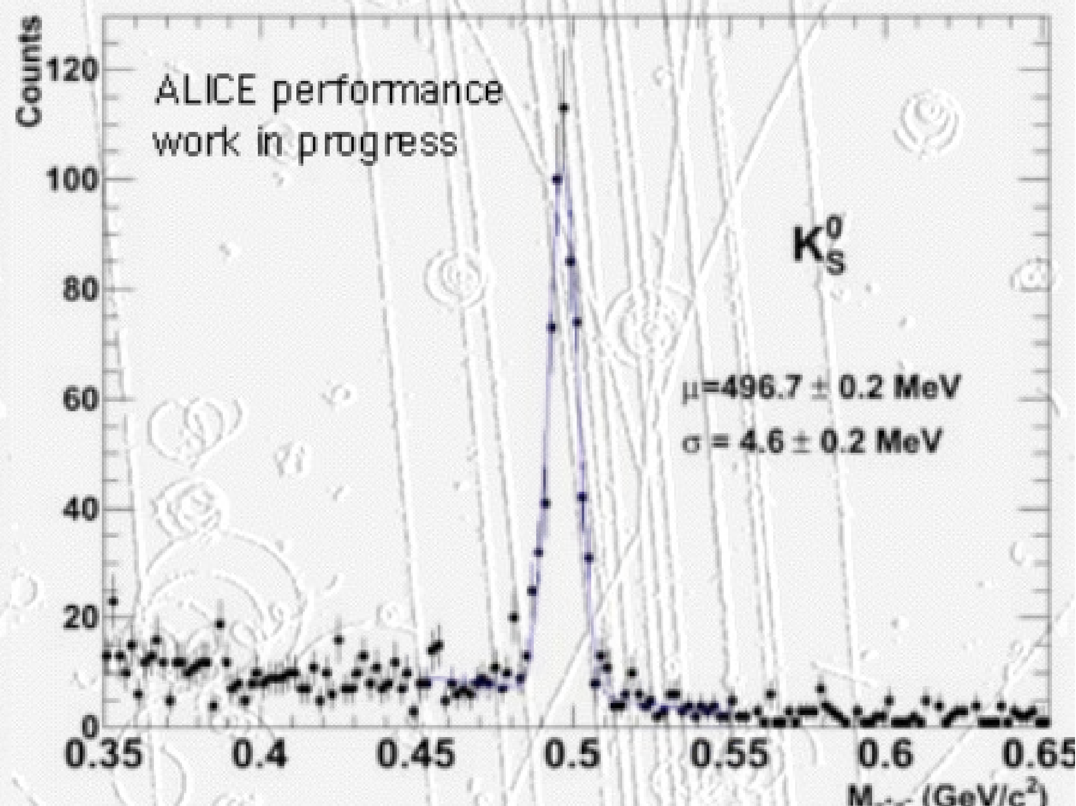
Identification

dE/dx:Alice



Ce n est pas le même K → $K^0_s \to \pi\pi$

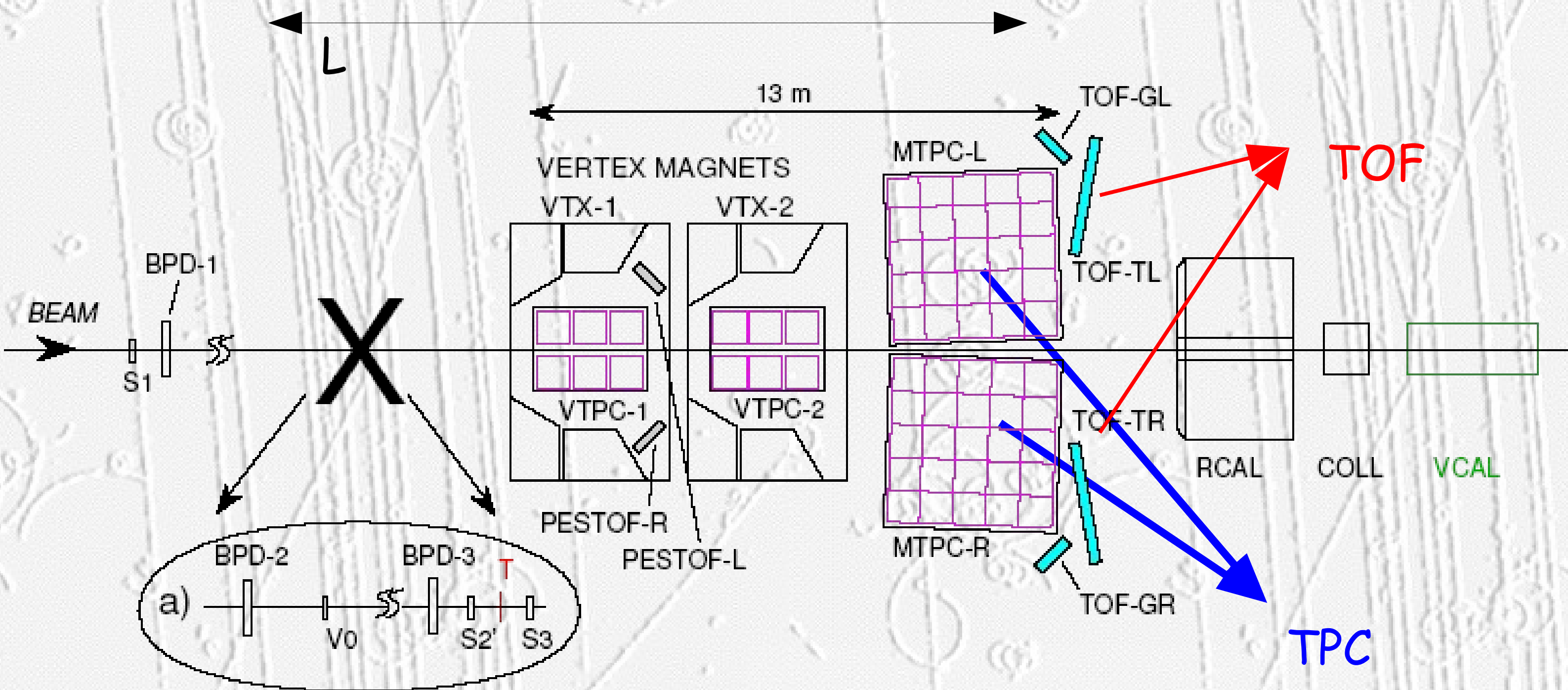




Identification

Temps de vol

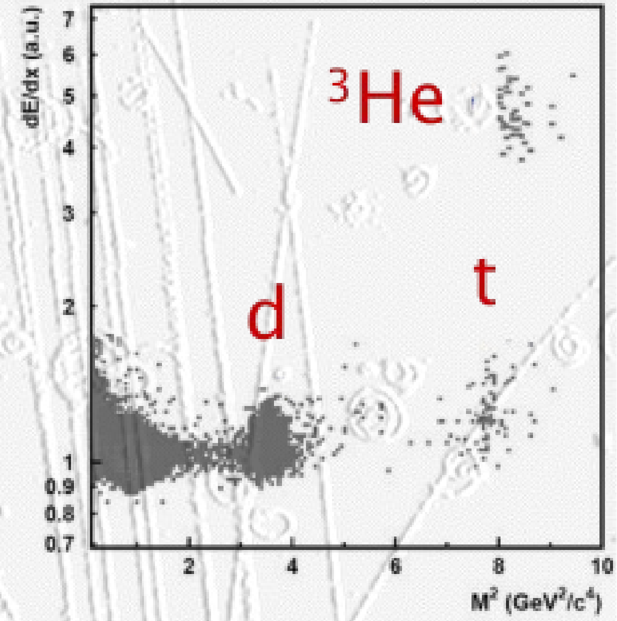
- Scintillateurs + PM:NA49
  - Entre le point d'interaction et un autre point
  - $\Delta t = L/\beta c$ et mesure de impulsion

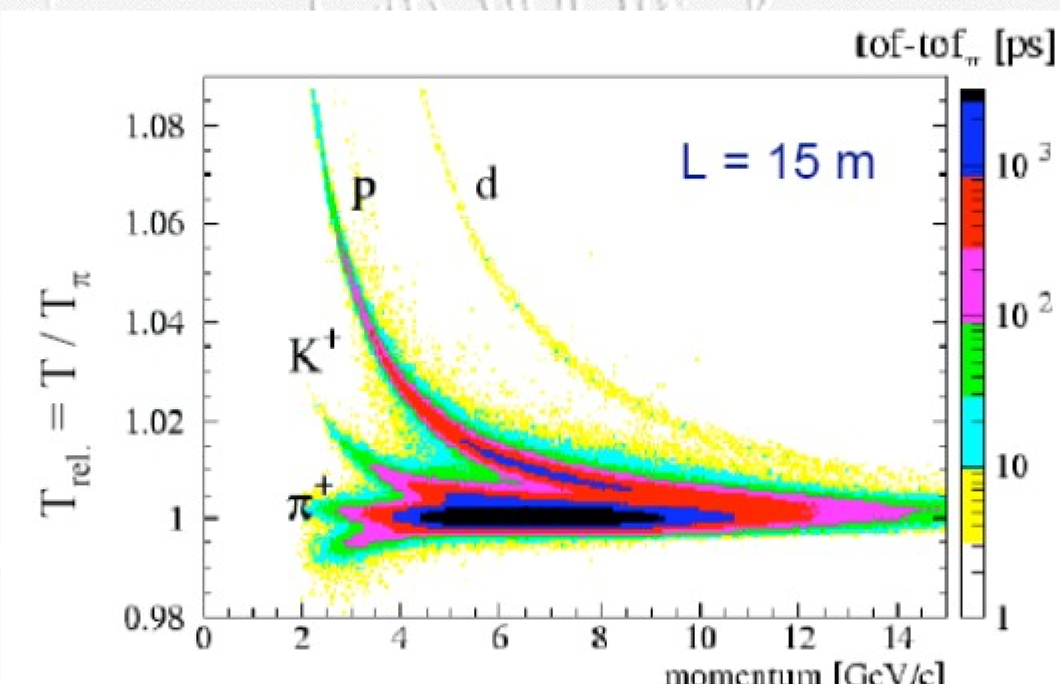


Identification

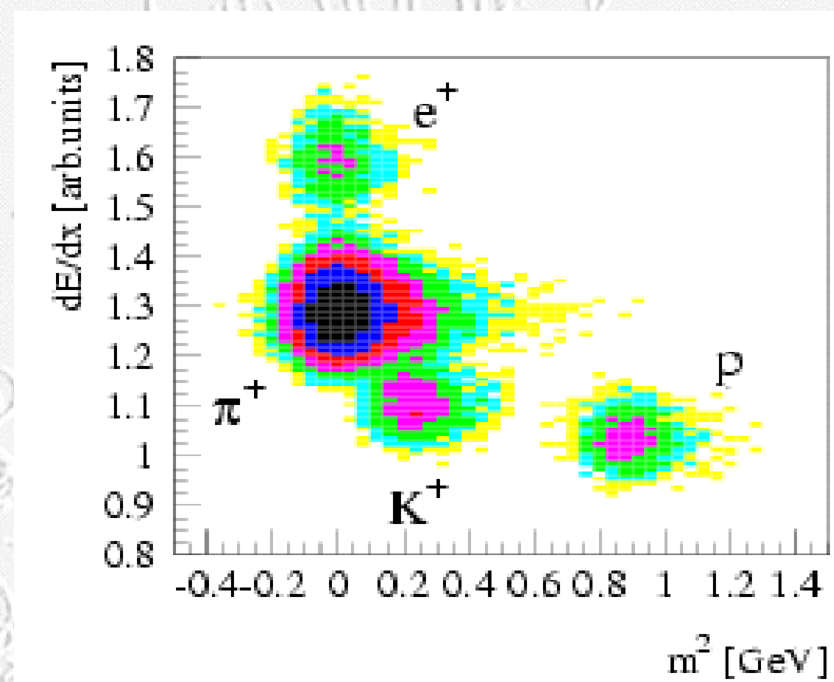
Temps de vol

- Scintillateurs + PM: Na 49



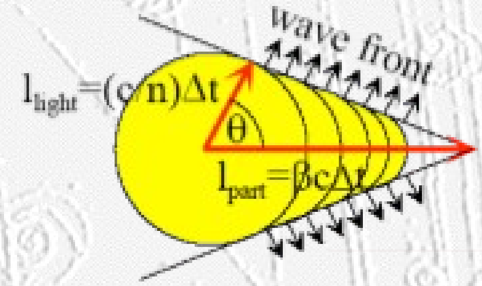


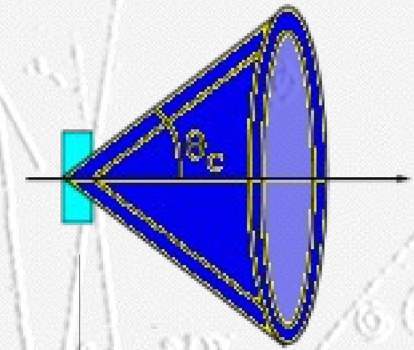
+dEdx



Gamme d'énergie : ~1-->~10 GeV

Identification

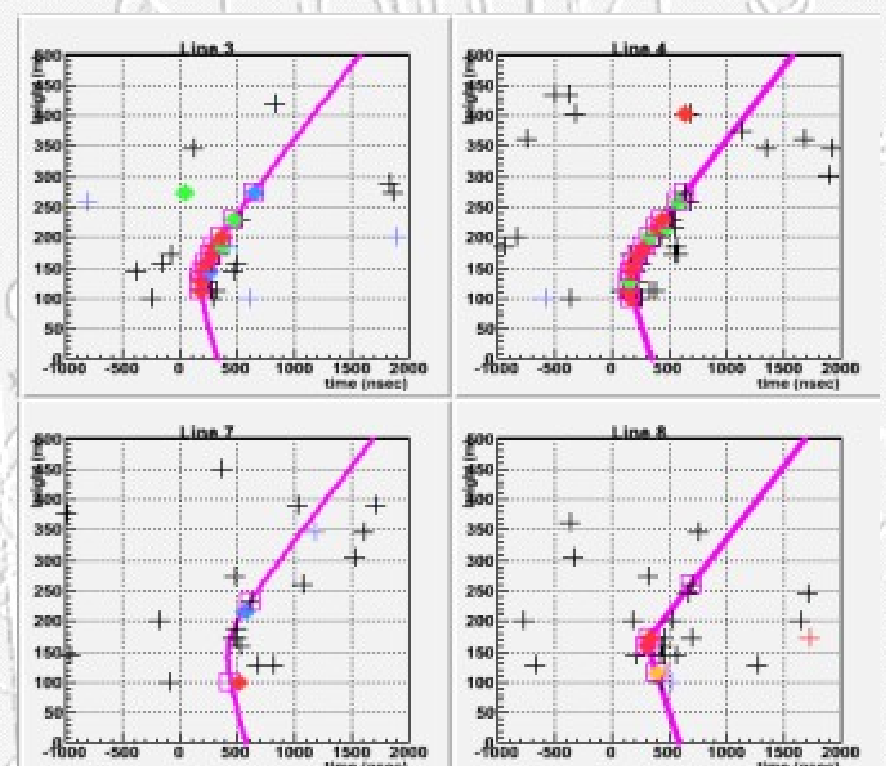


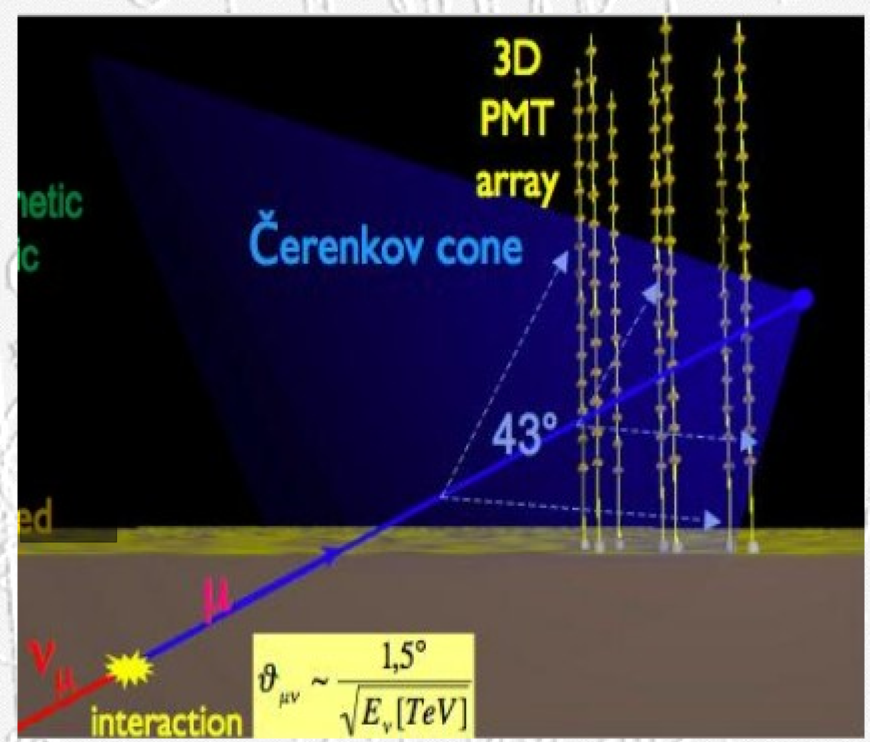


Rayonnement Cherenkov

- Radiation(photons) tangente à cône d'angle θ_C autour de la trace: $\cos\theta_C = (n\beta)^{-1}$

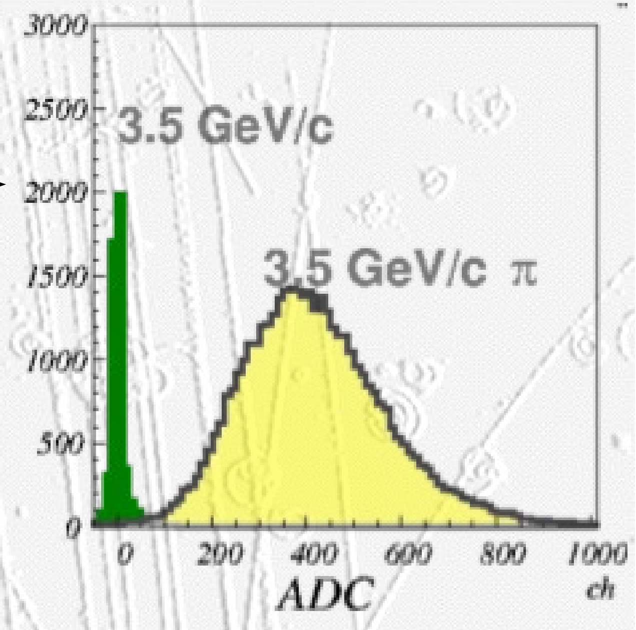
Changement d'indice





Identification

Belle : séparation ?/π



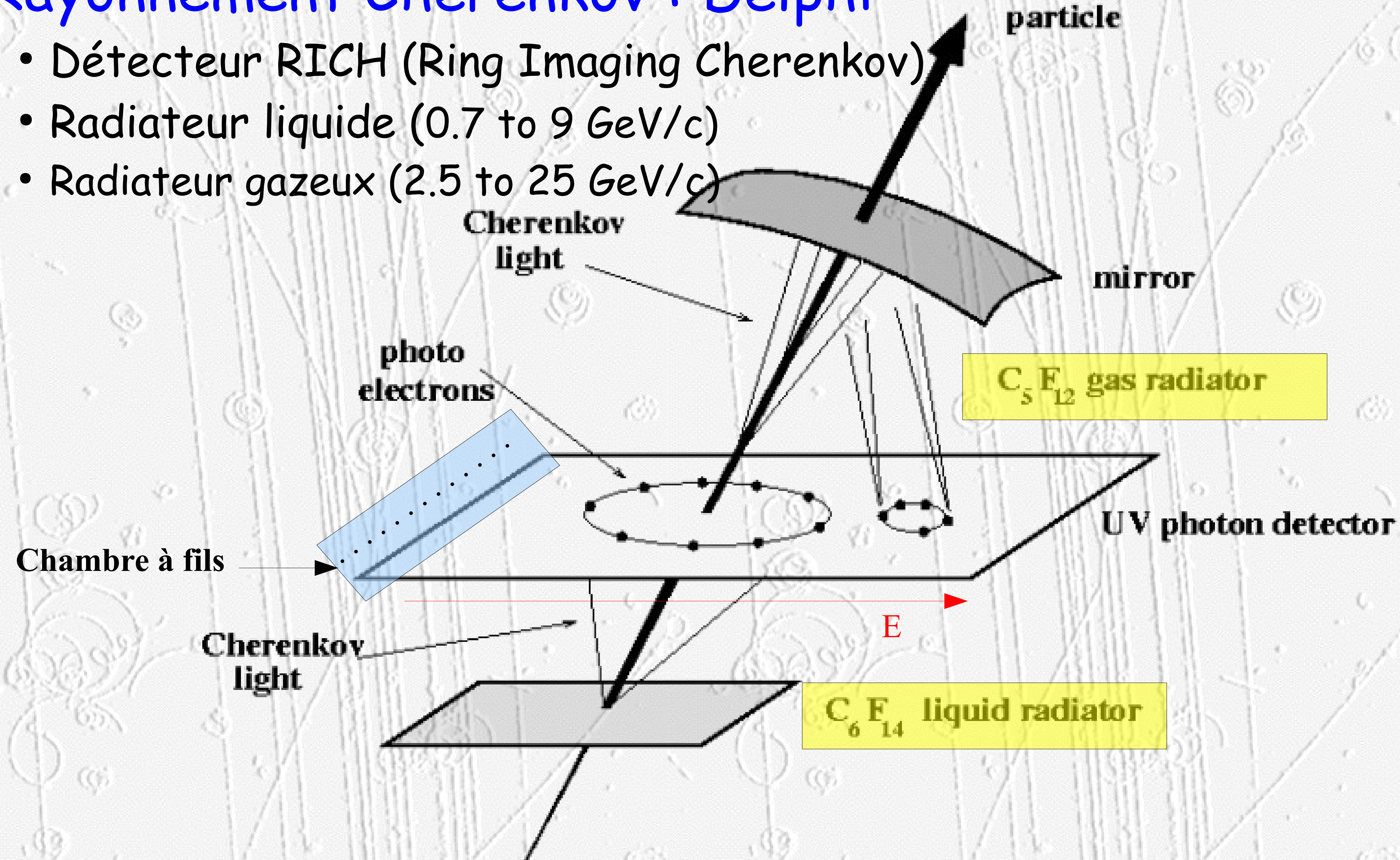
Rayonnement Cherenkov

- Détecteur à seuil
- Choix astucieux du milieu va permettre de produire ou non la radiation Cherenkov β=1/n

Identification

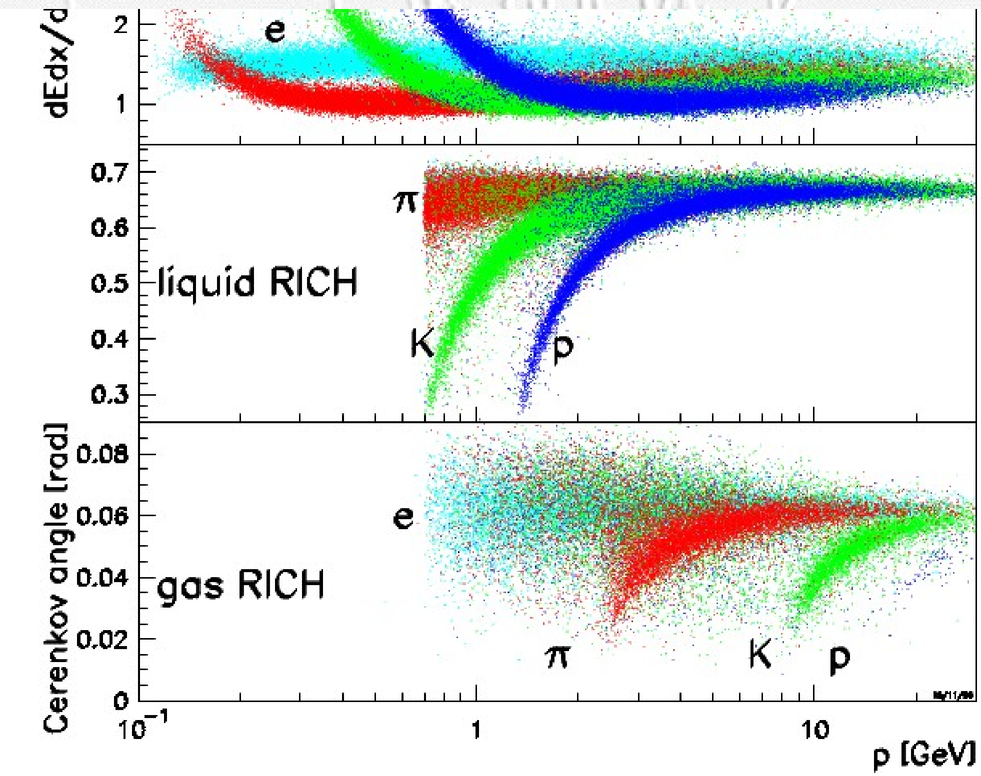
Rayonnement Cherenkov : Delphi

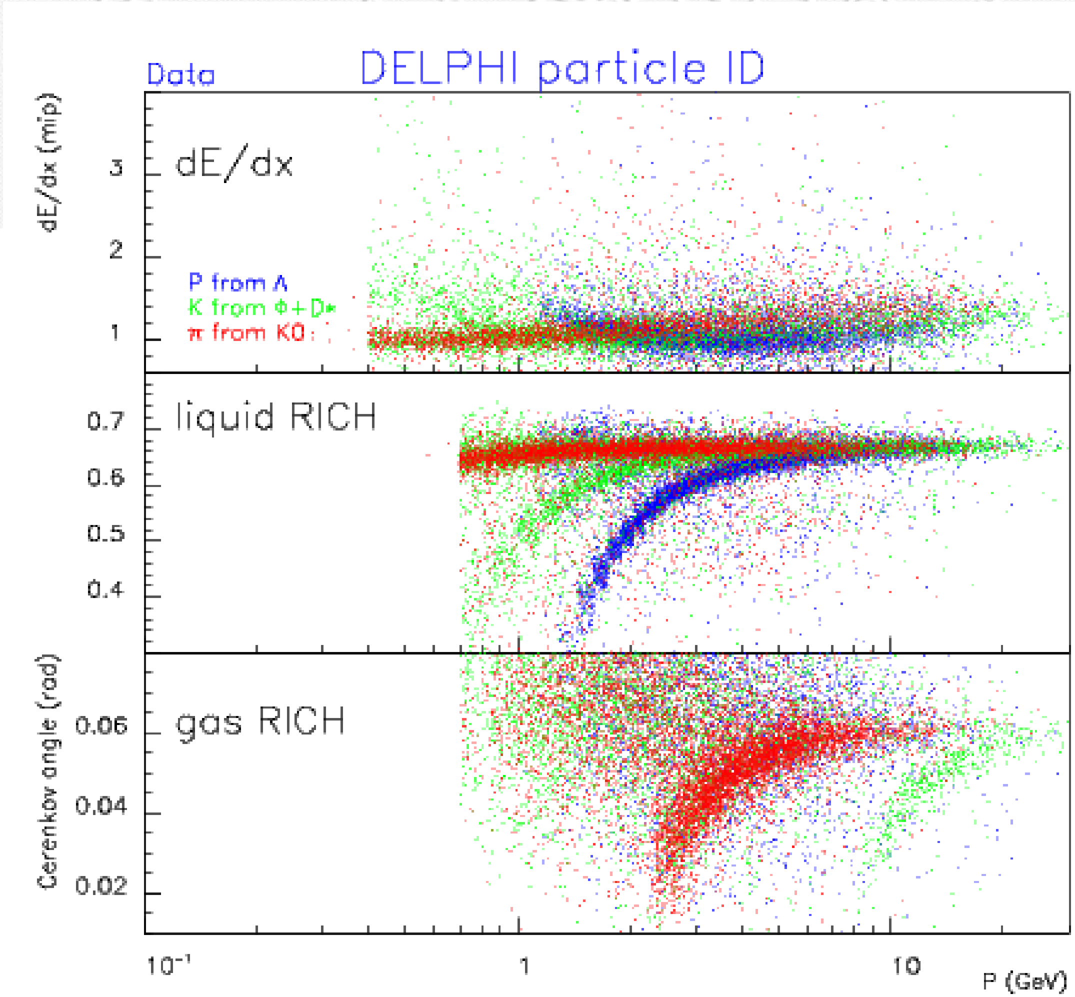
- Détecteur RICH (Ring Imaging Cherenkov)
- Radiateur liquide (0.7 to 9 GeV/c)
- Radiateur gazeux (2.5 to 25 GeV/c)



Identification

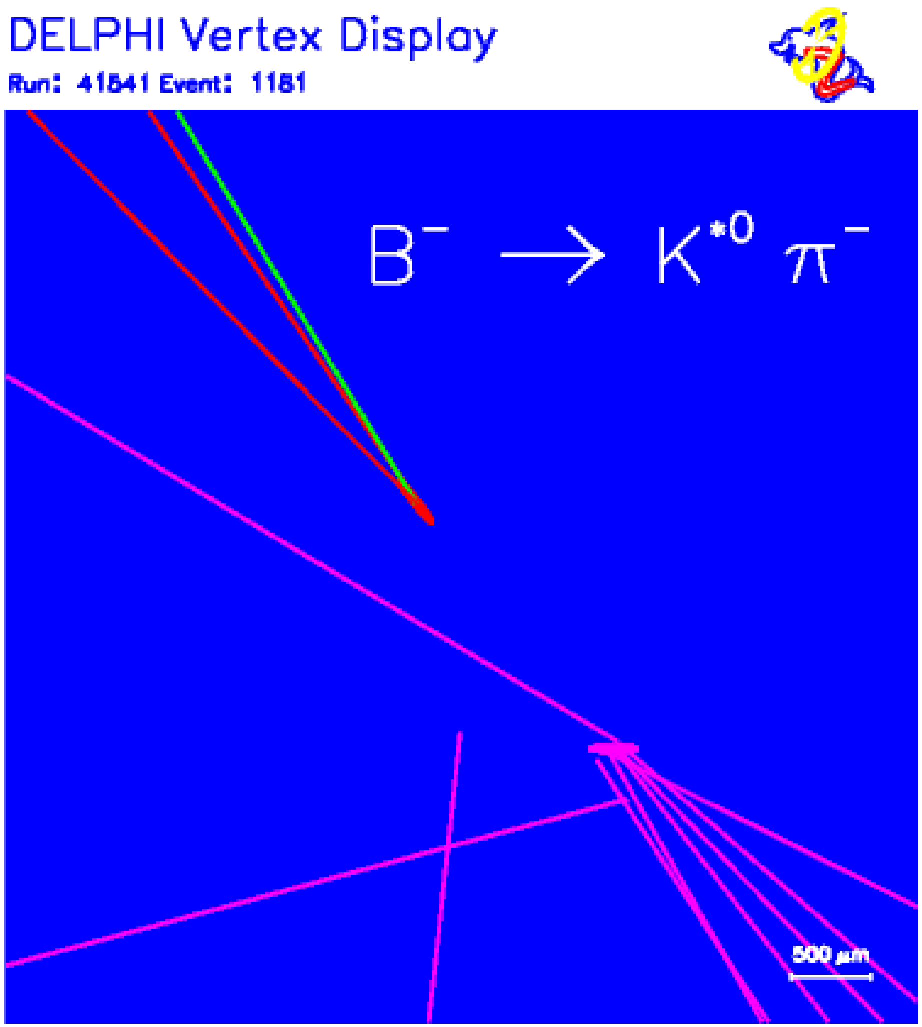
Rayonnement Cherenkov: Delphi

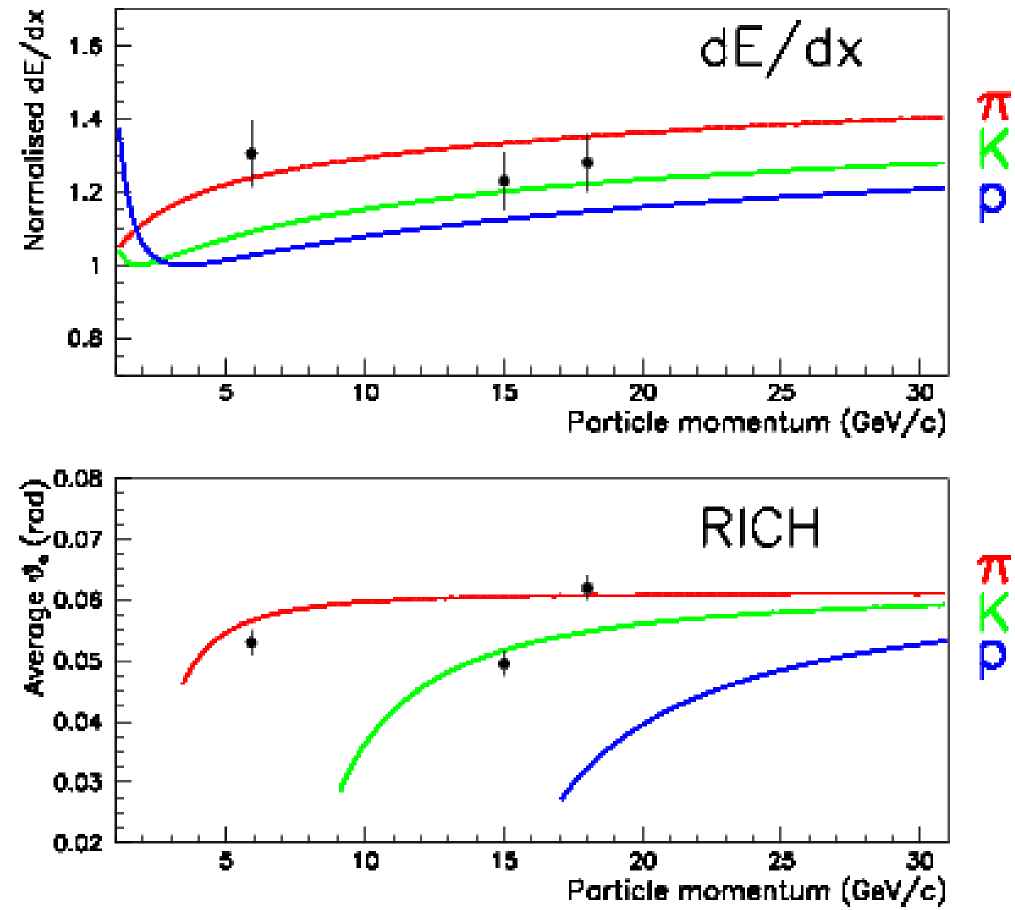




Identification

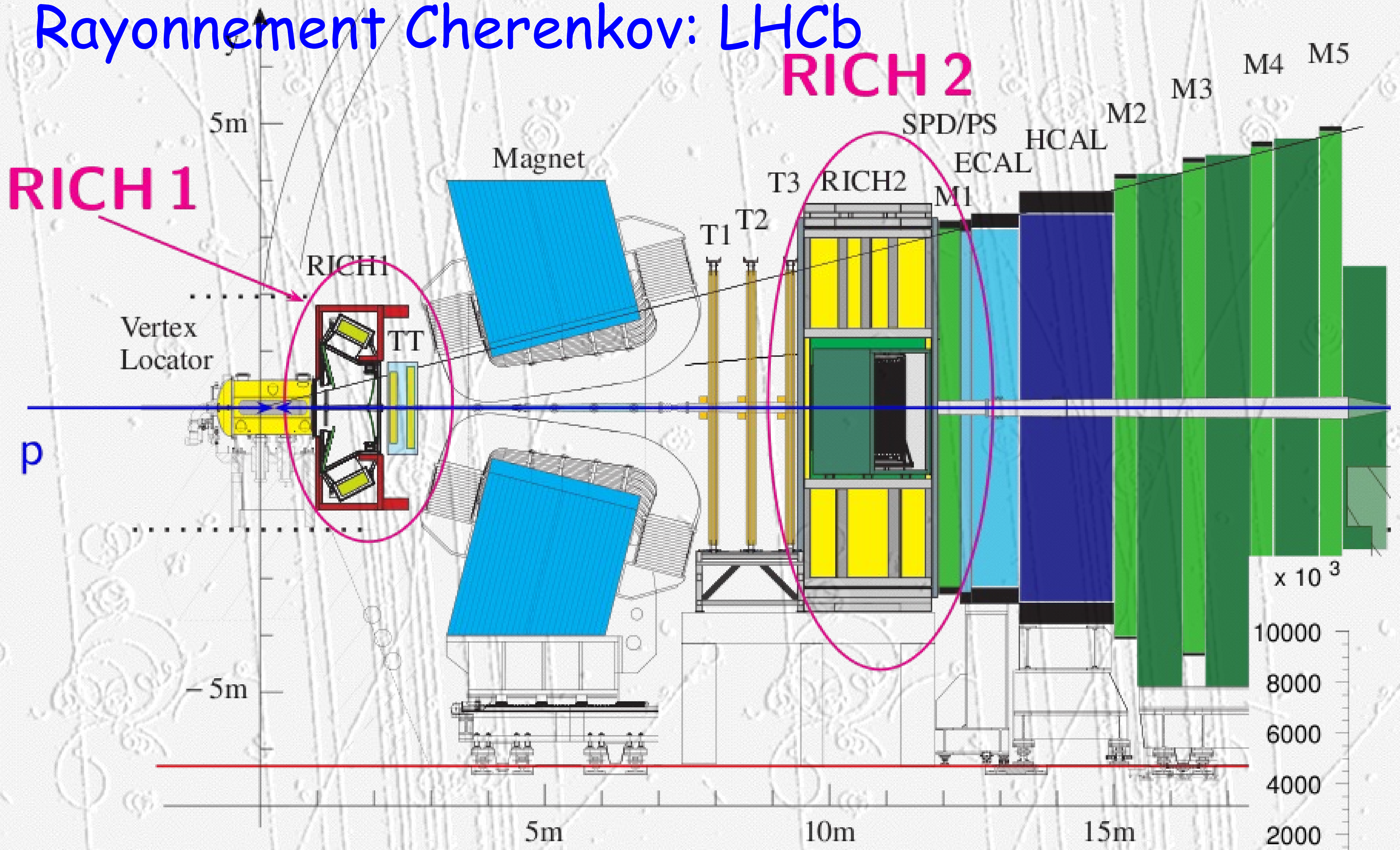
Rayonnement Cherenkov + dE/dx: Delphi





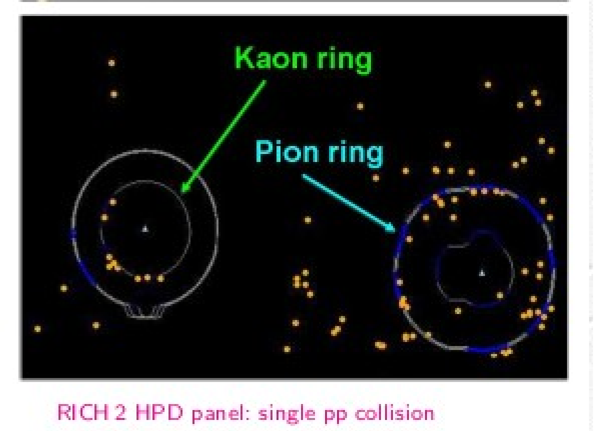
Identification

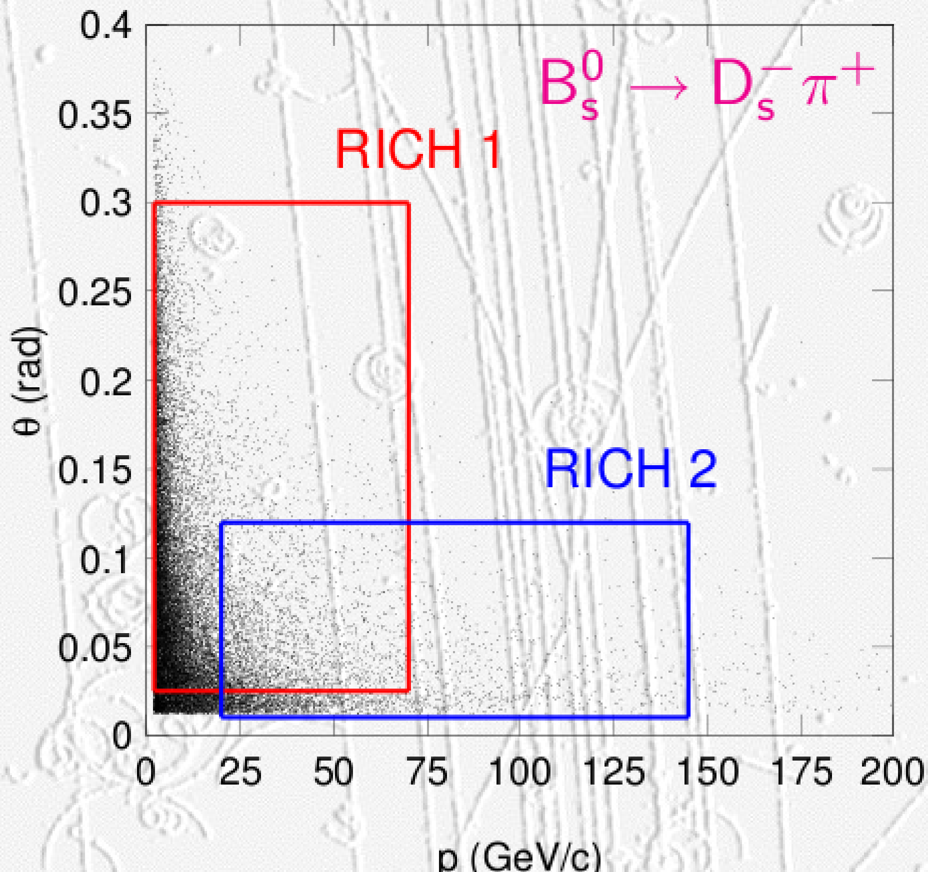
Rayonnement Cherenkov: LHCb

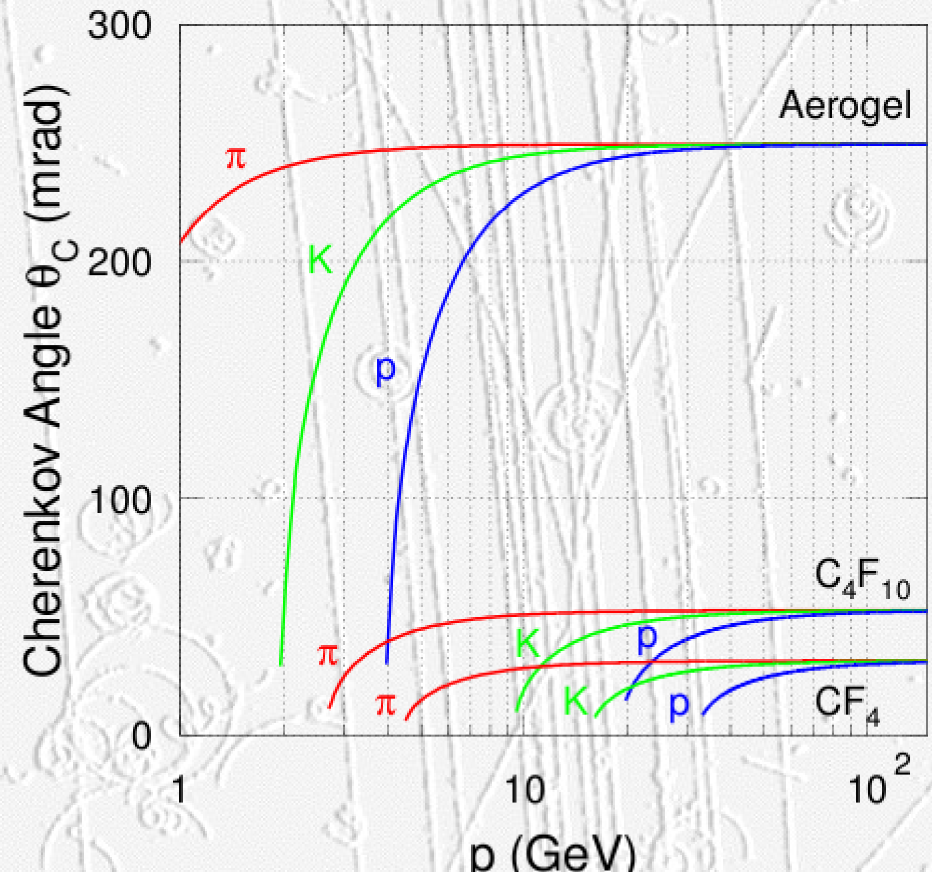


Identification

Rayonnement Cherenkov: LHCb

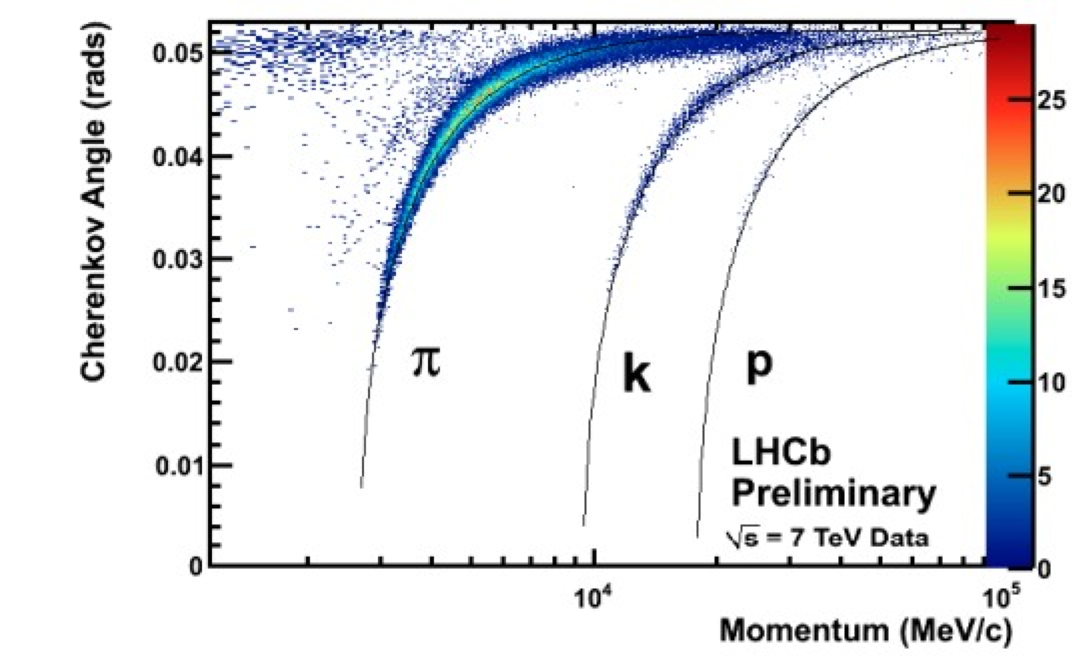


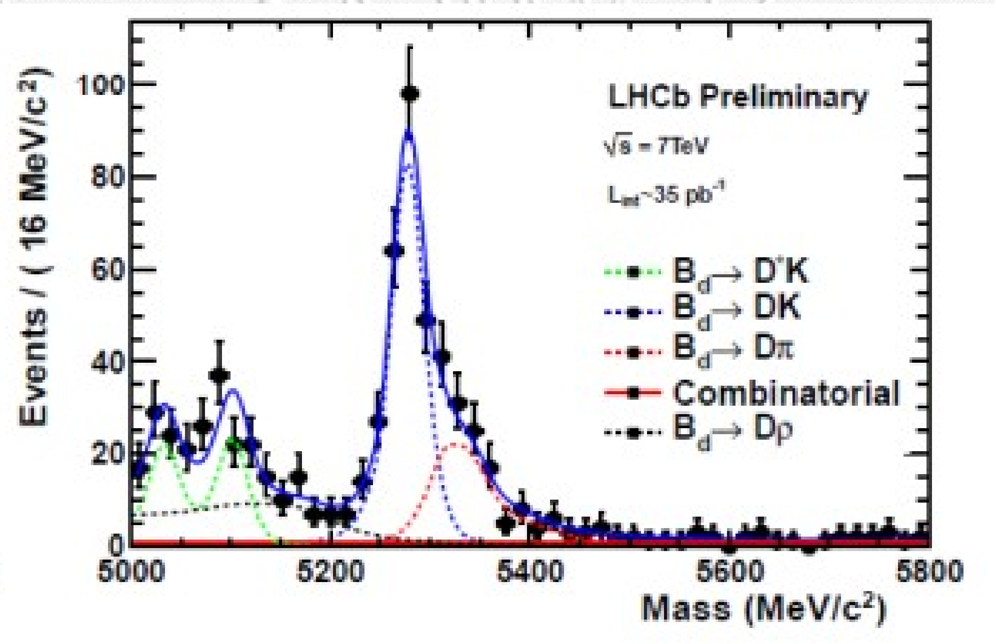




Identification

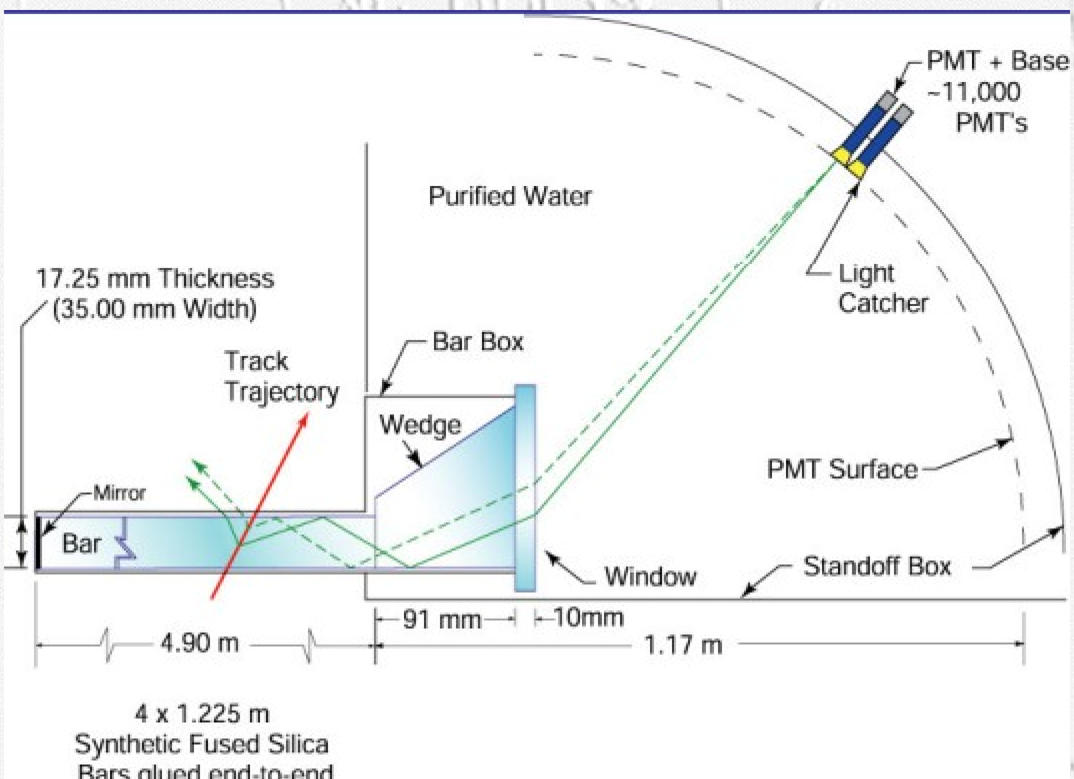
Rayonnement Cherenkov: LHCb

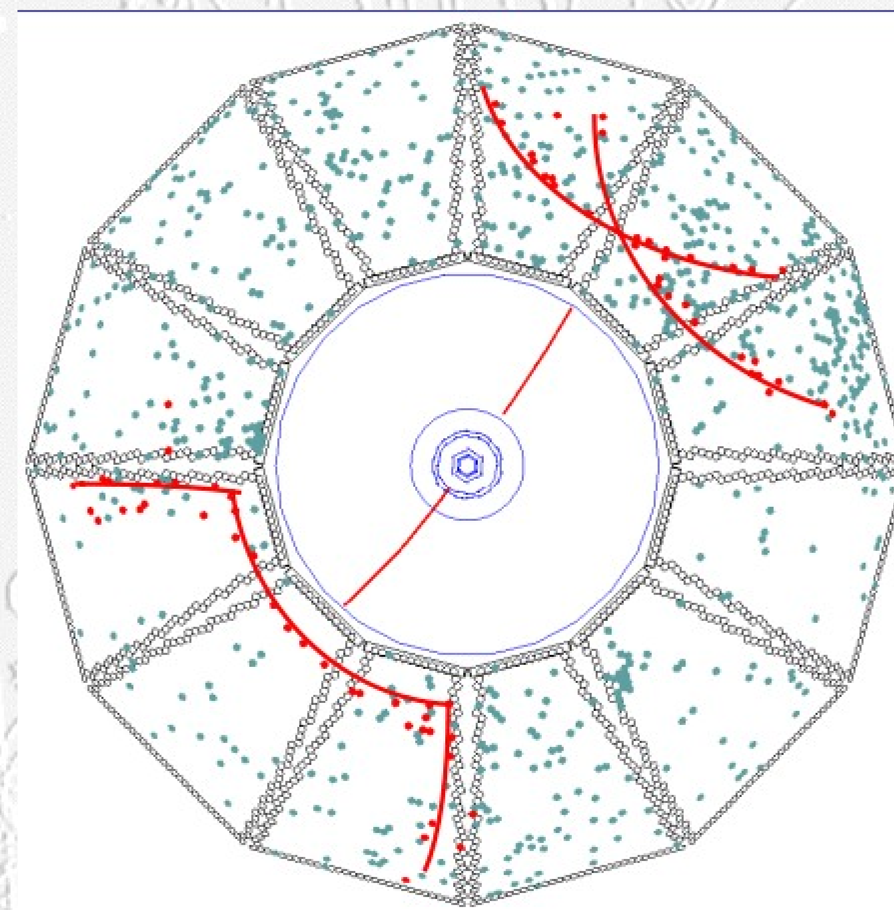




Identification

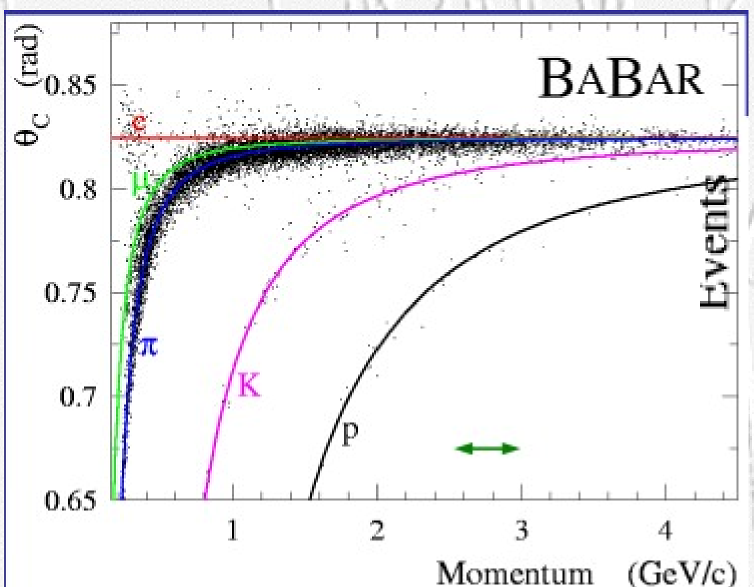
Rayonnement Cherenkov: BaBar

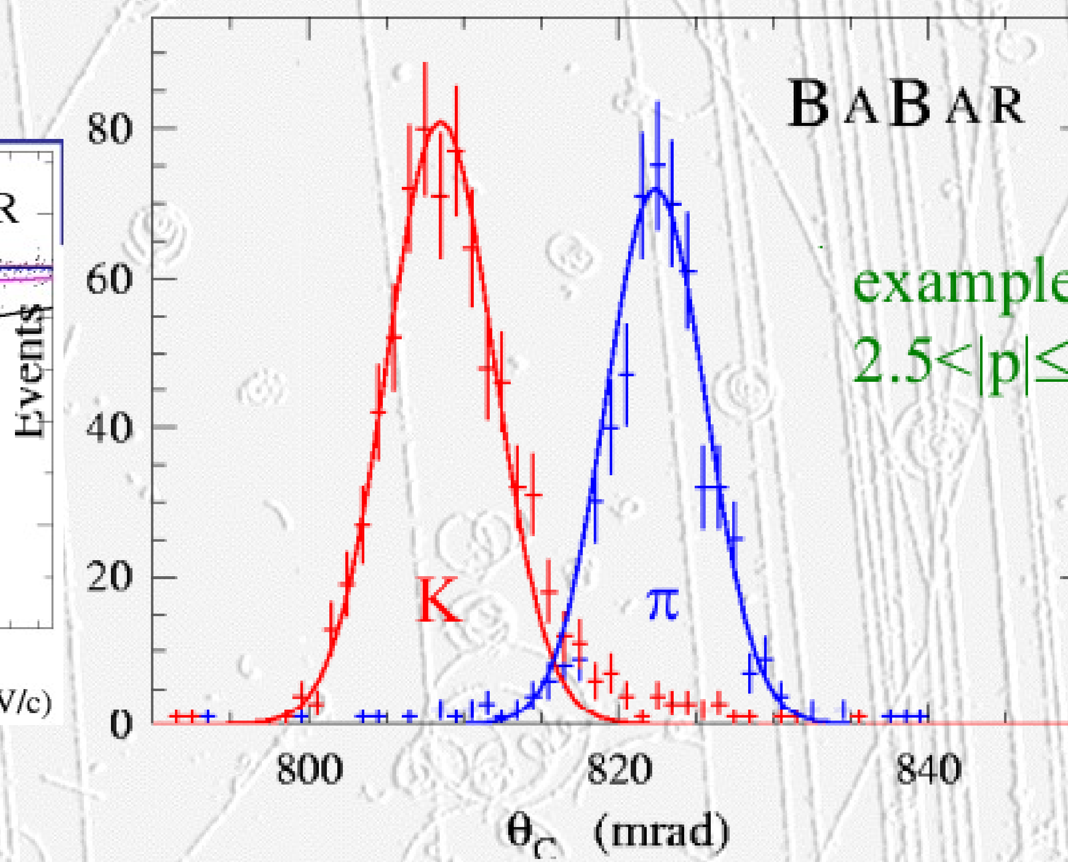




Identification

Rayonnement Cherenkov: BaBar

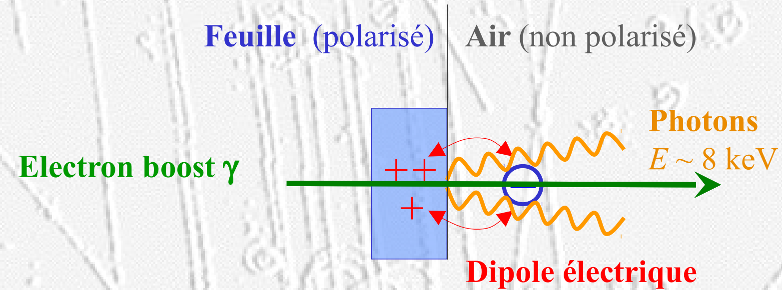




example:
2.5<|p|≤3GeV/c

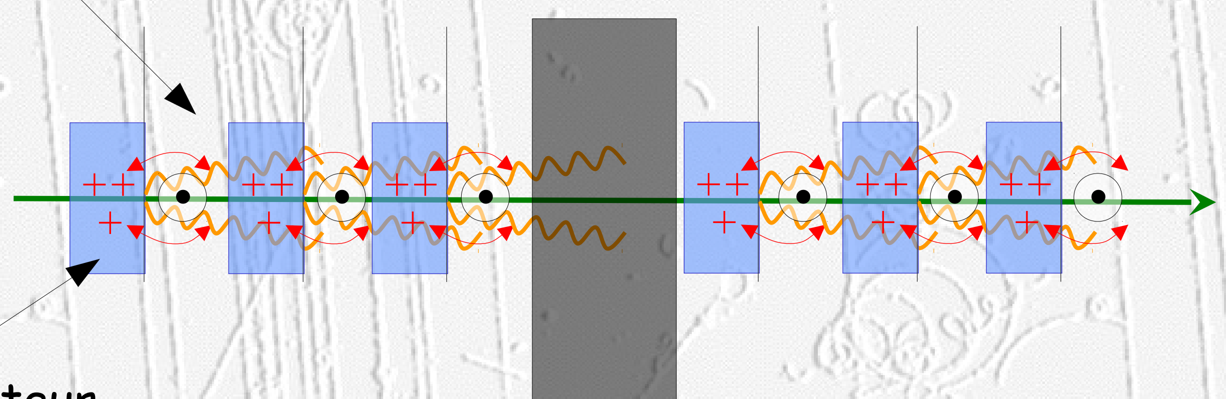
Identification

Rayonnement de Transition



- Atlas : TRT
  - Radiation de transition proportionnelle à γ
  - Photon est proportionnelle cste de structure fine : ~1/137
  - Cohérence des photons => besoin de moins de 100 transitions

Détecteur



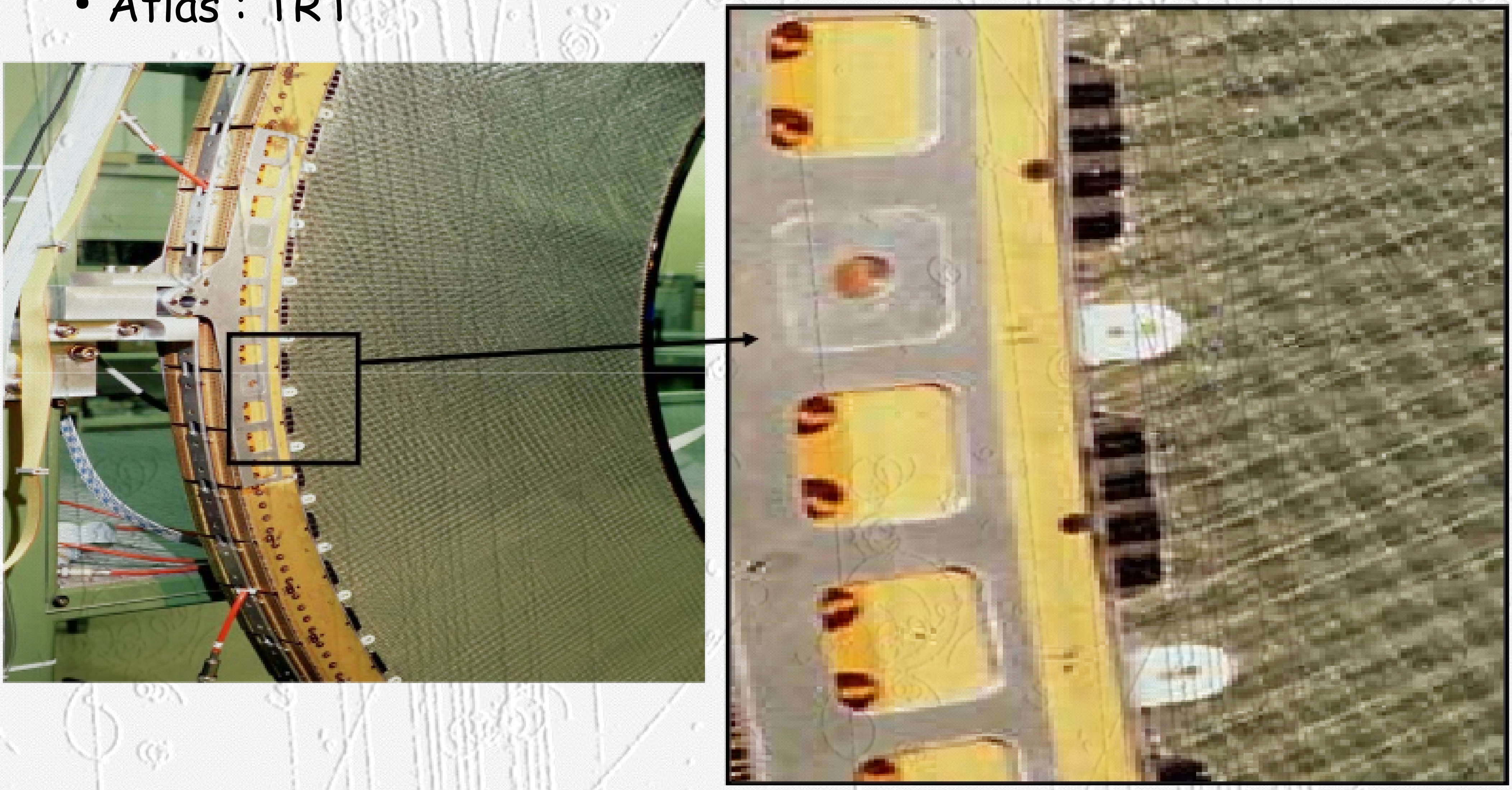
Radiateur

support :
tous les photons de RT sont absorbés

Identification

Rayonnement de Transition

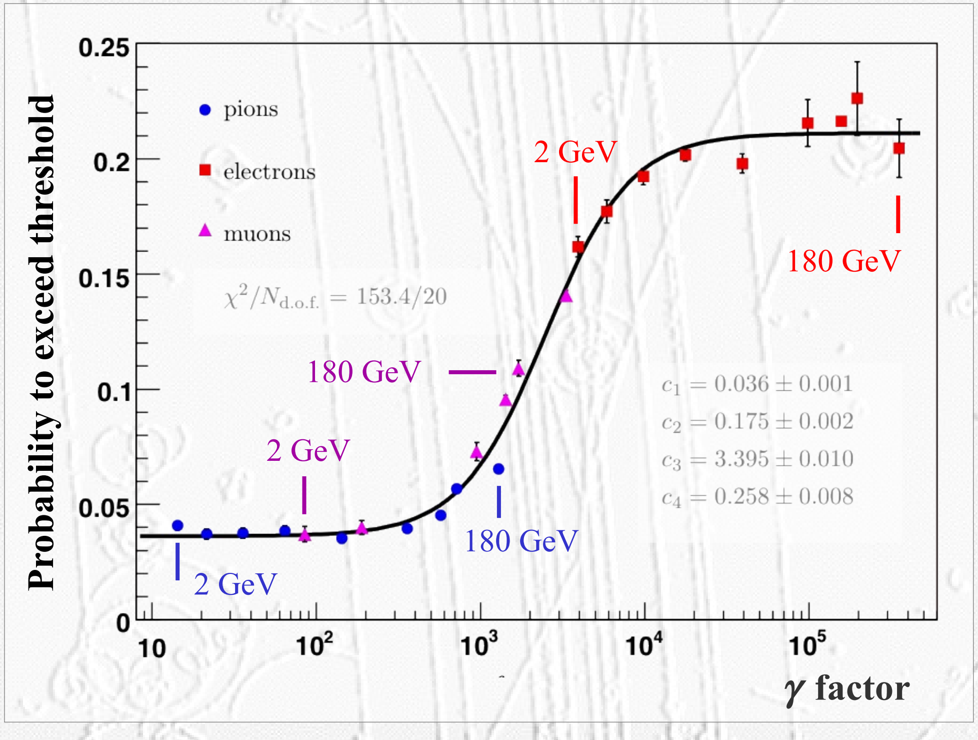
- Atlas : TRT

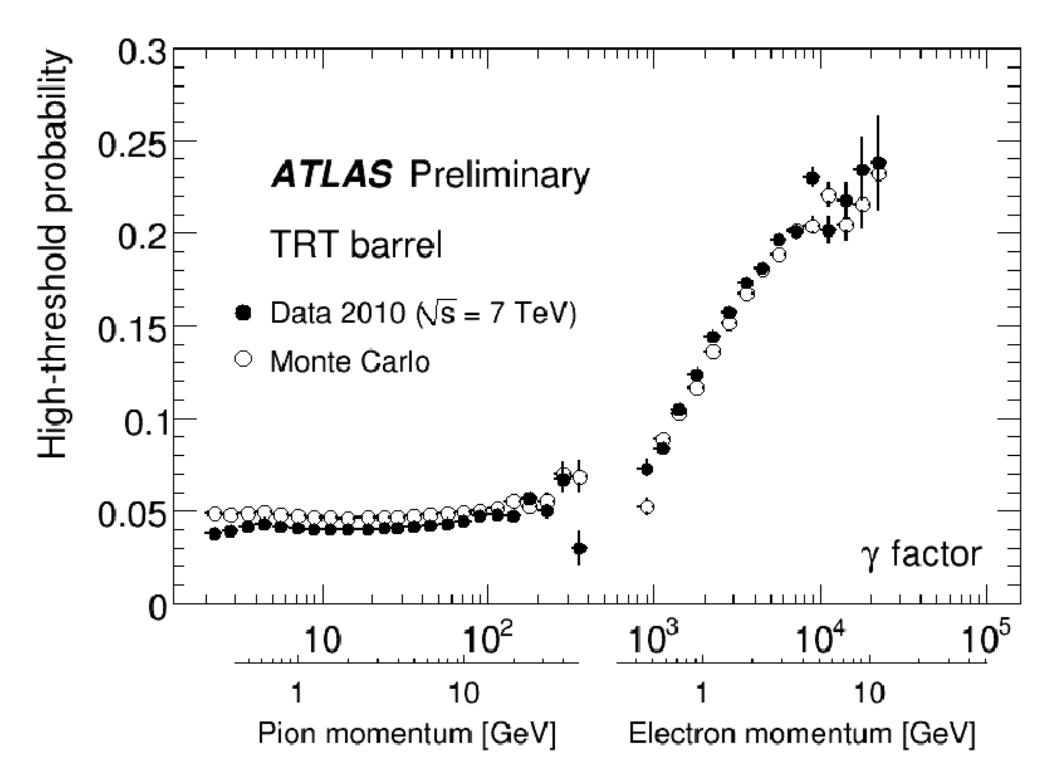


Identification

Rayonnement de Transition

- Atlas : TRT





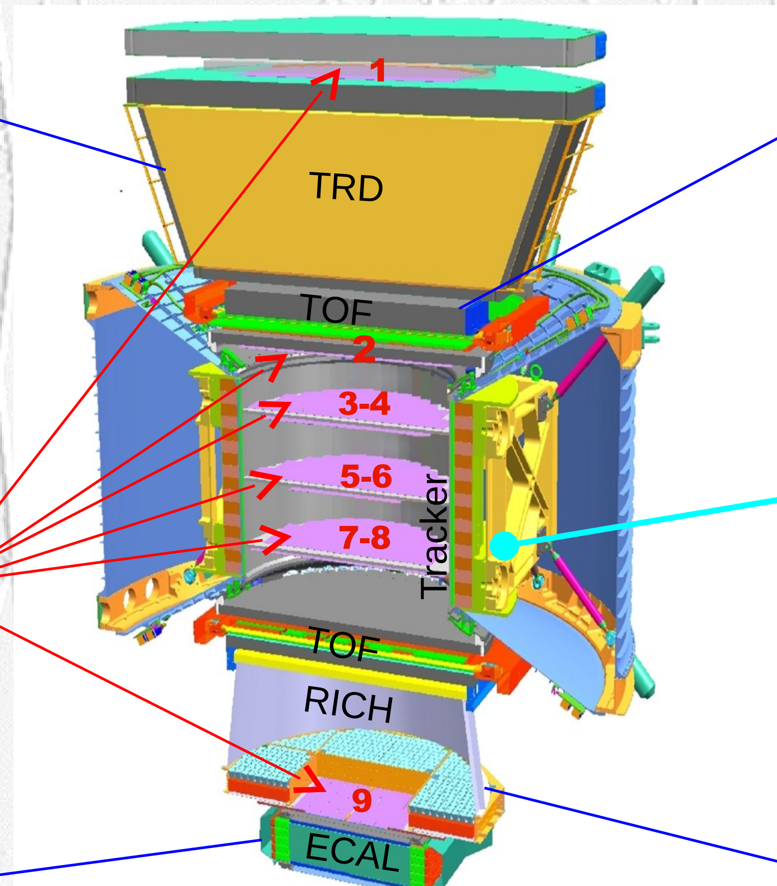
Identification

Exemple AMS2

TRD
Identification e+, e-

Silicium
Z, P

ECAL
E of e+, e-, γ



TOF
Z, E

Magnet
±Z

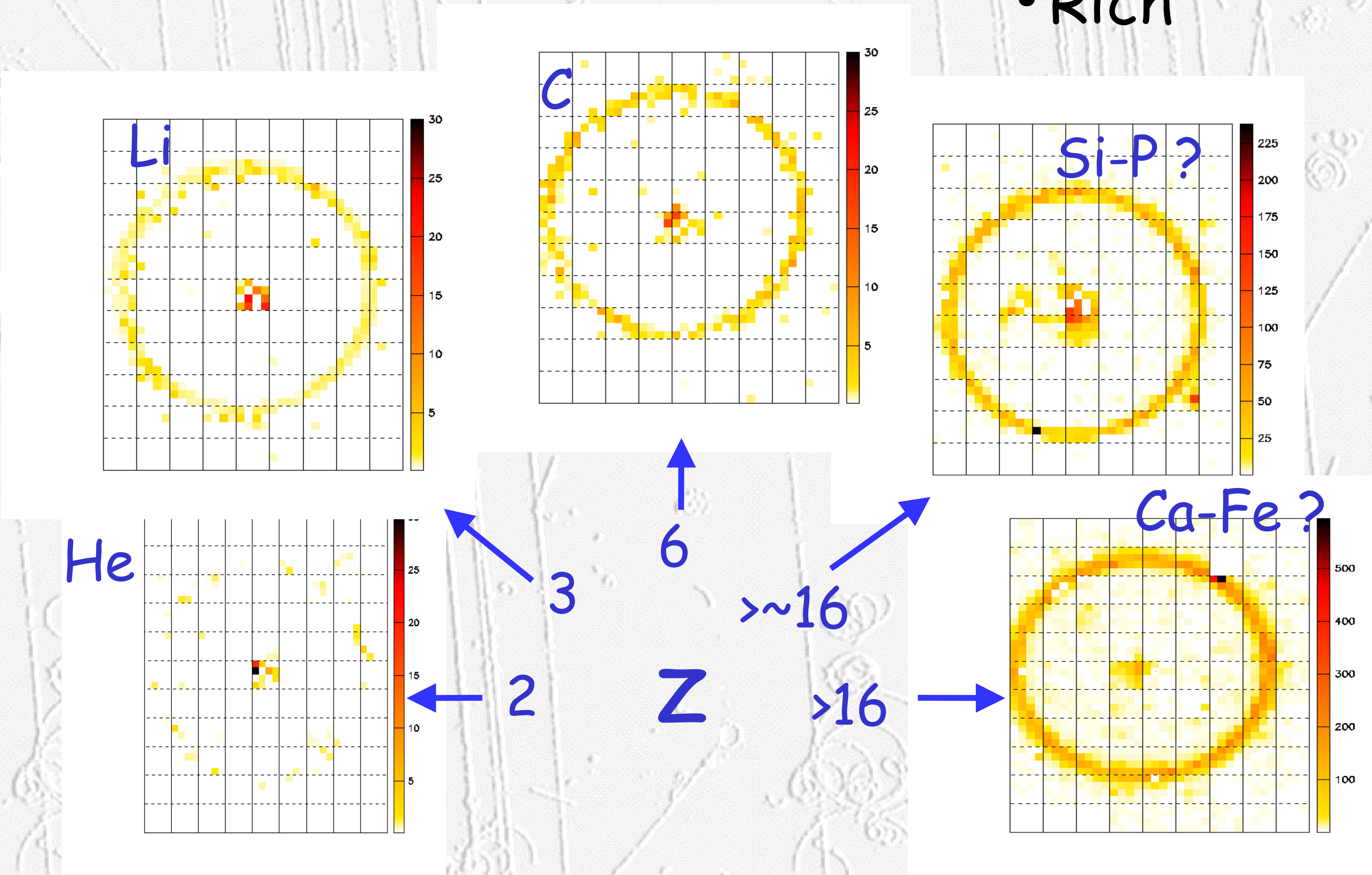
RICH
Z, E

Z, P sont mesurés indépendamment par Tracker, RICH, TOF and ECAL

Identification

Exemple AMS2

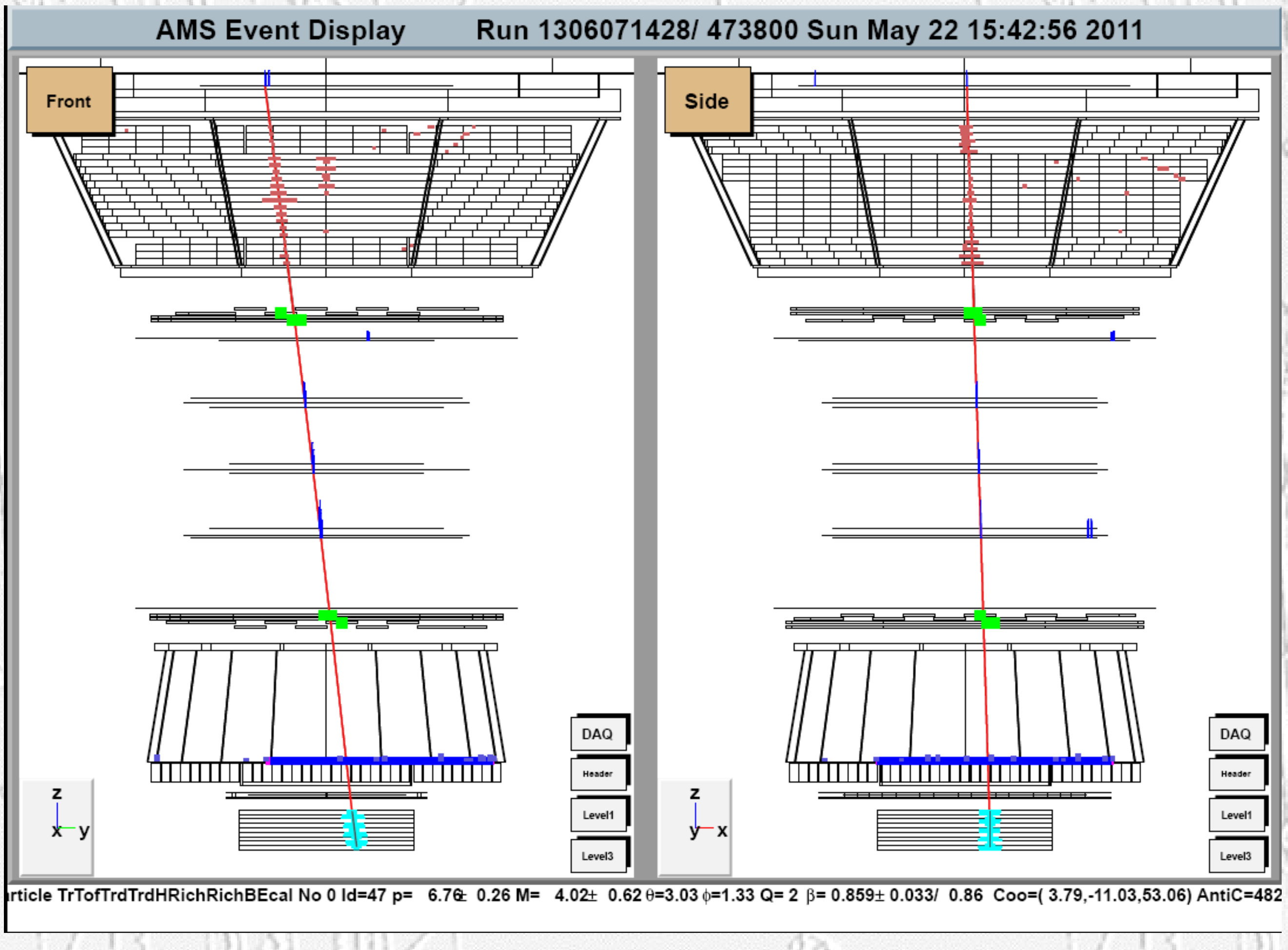
- Rich



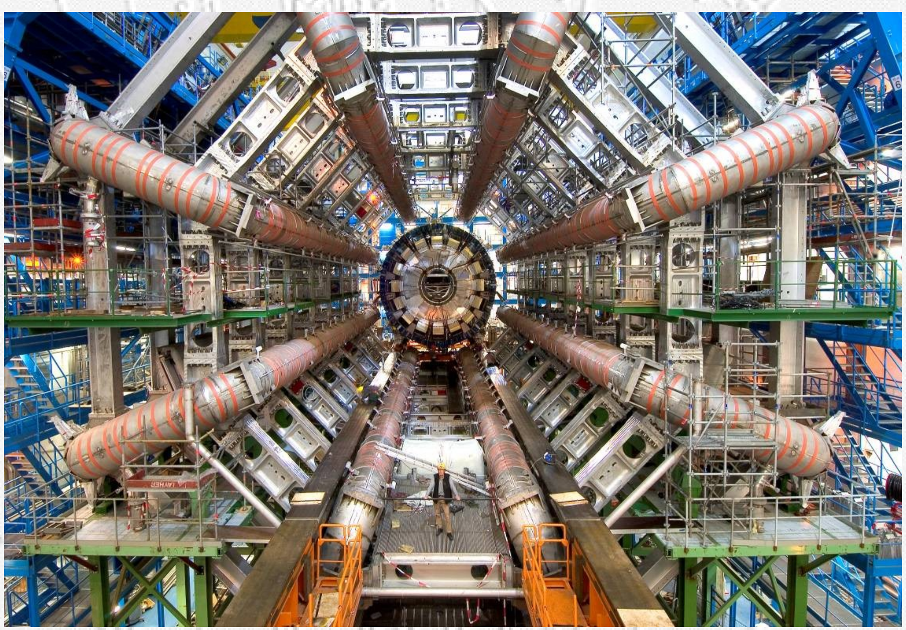
Identification

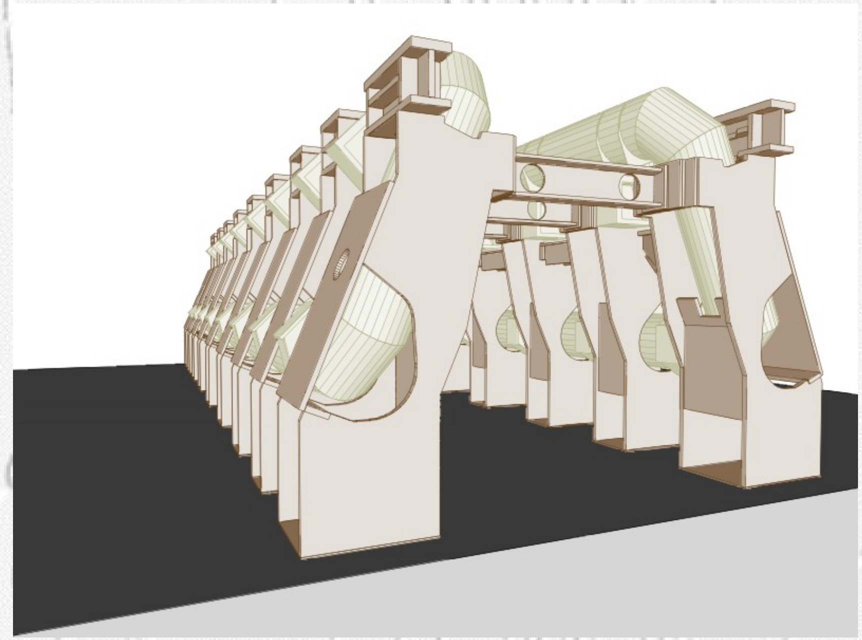
Exemple AMS2

- Candidat He



ATLAS





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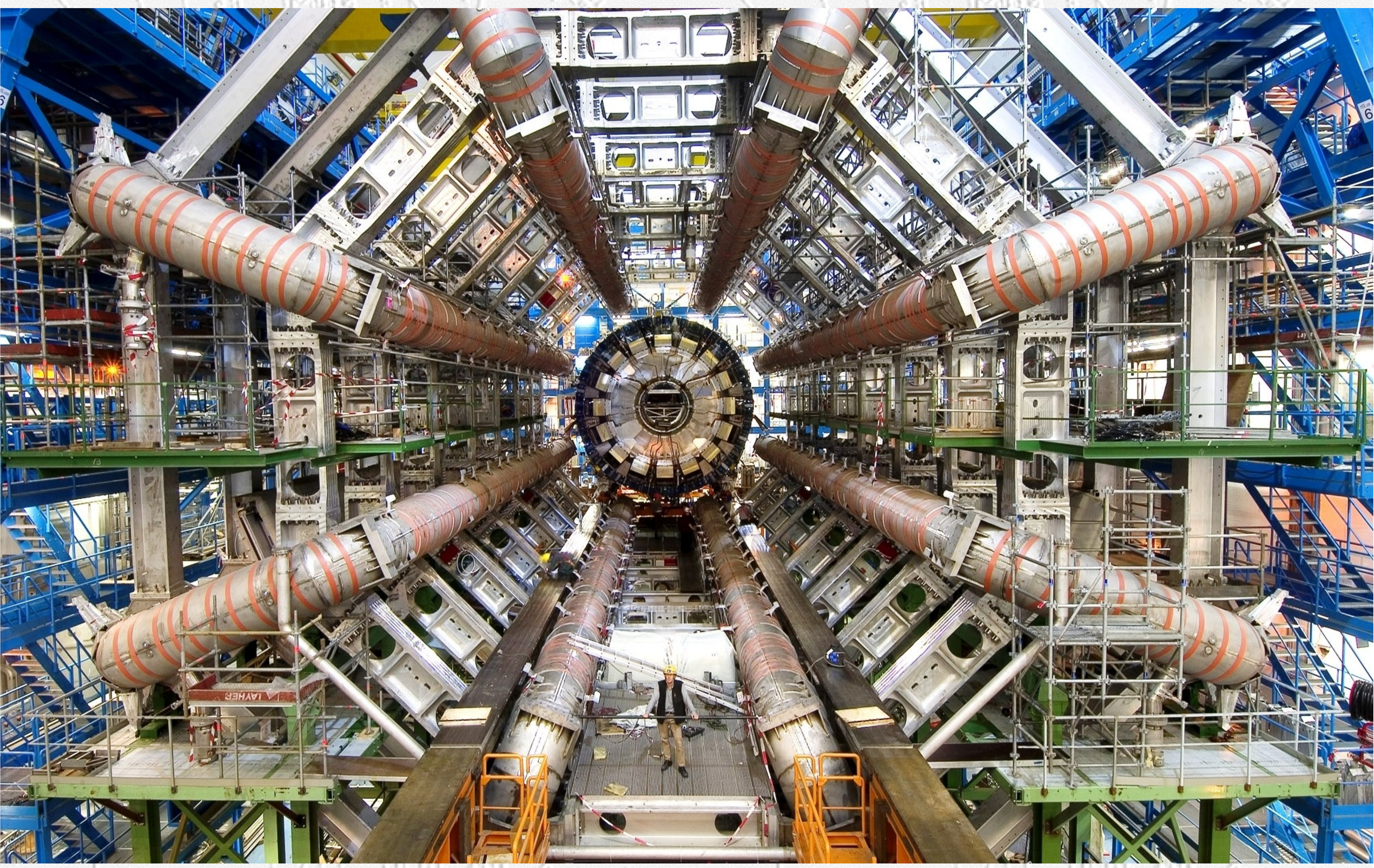
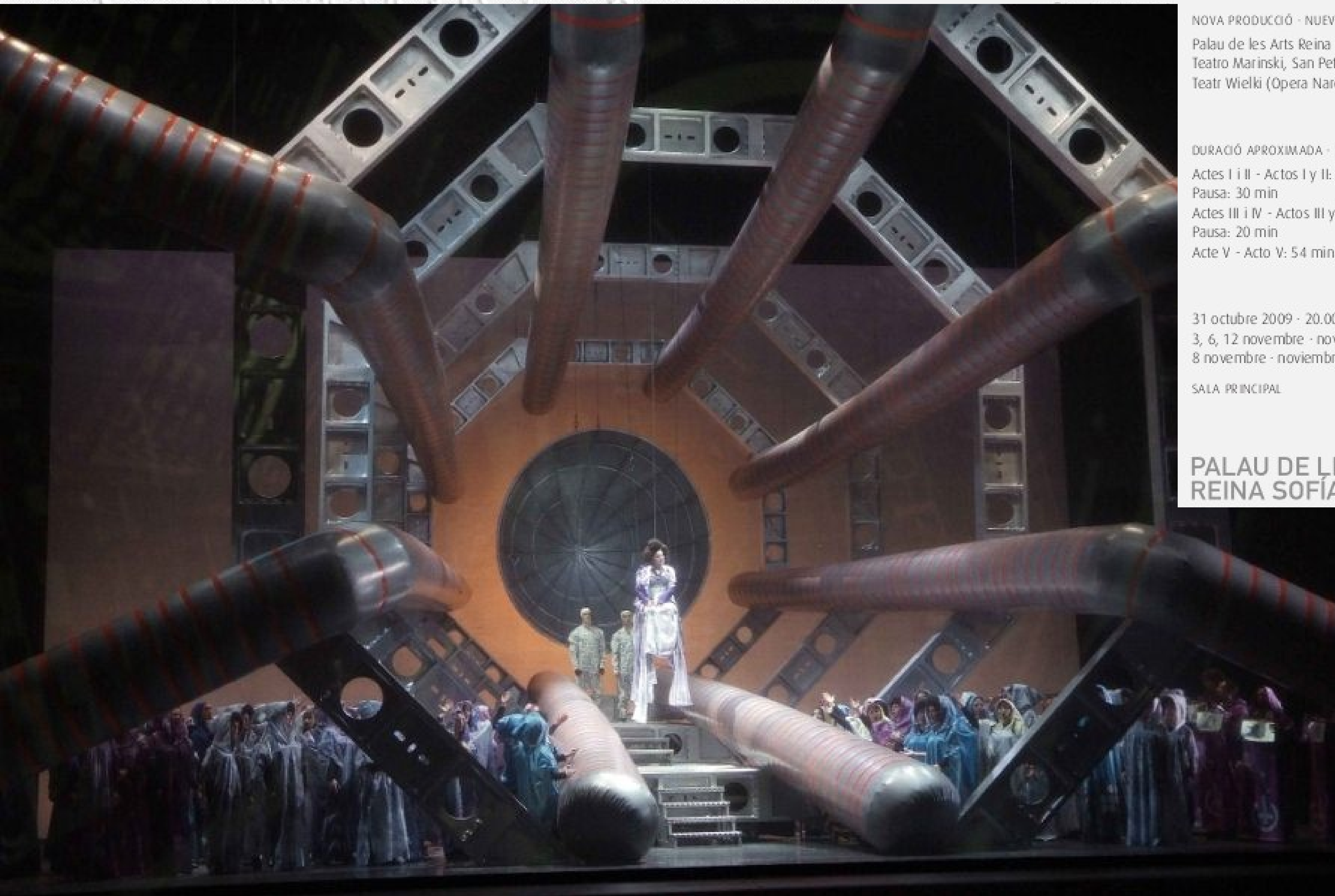


ATLAS

Valence, Espagne

HECTOR BERLIOZ Les Troyens



NOVA PRODUCCIÓ · NUEVA PRODUCCIÓN

Palau de les Arts Reina Sofia
Teatro Marinski, San Petersburgo
Teatr Wielki (Opera Narodowa), Varsovia

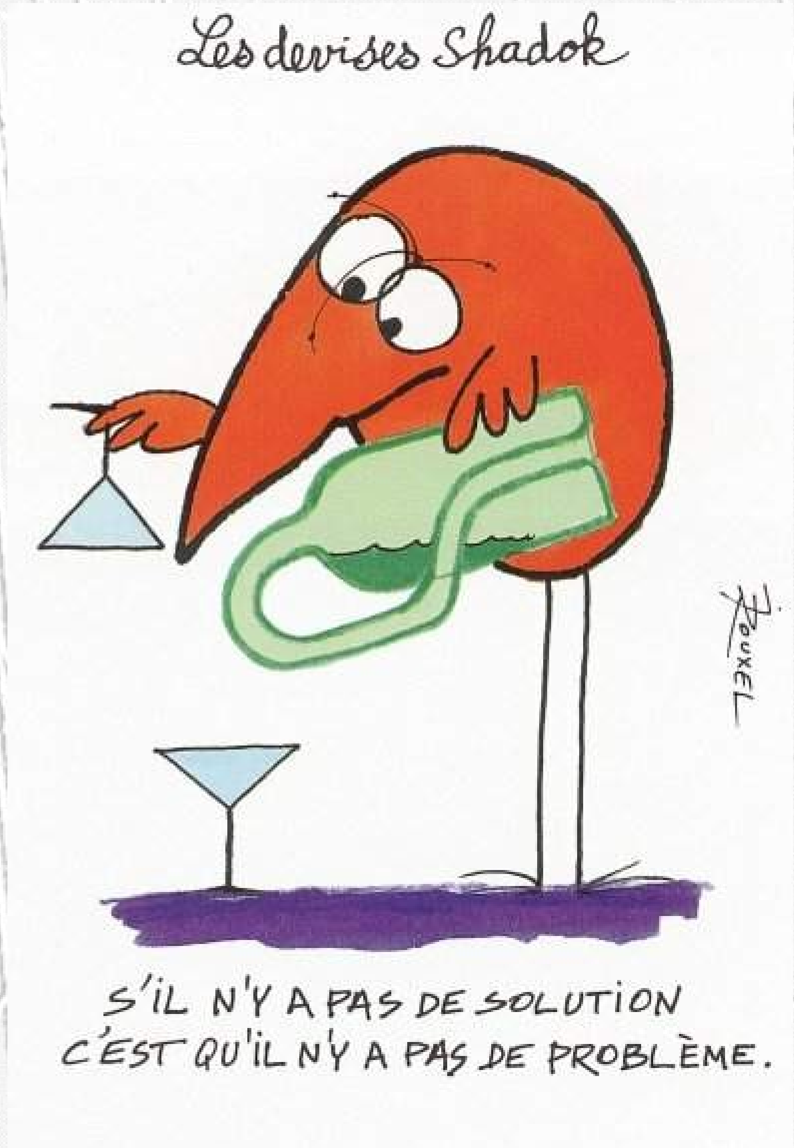
DURACIÓ APROXIMADA · DURACIÓN APROXIMADA

Actes I i II - Actos I y II: 1 h 21 min
Pausa: 30 min
Actes III i IV - Actos III y IV: 1 h 42 min
Pausa: 20 min
Acte V - Acto V: 54 min

31 octubre 2009 · 20.00 h
3, 6, 12 novembre · noviembre 2009 · 20.00 h
8 novembre · noviembre 2009 · 19.00 h

SALA PRINCIPAL

PALAU DE LES ARTS
REINA SOFÍA Temporada 2


Les devises Shadok
S'IL N'Y A PAS DE SOLUTION
C'EST QU'IL N'Y A PAS DE PROBLÈME.
ROUXEL